REPORT ON

ZARDOUS WASTE MANAGEMENT GROUNDWATER ASSESSMENT PROGRAM

AT

LORAIN WORKS

TO

UNITED STATES STEEL CORPORATION

August 1983

Prepared By

MICHAEL BAKER, JR., INC.
BAKER/TSA DIVISION
Beaver, Pennsylvania

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HAZARDOUS WASTE MANAGEMENT GROUNDWATER
ASSESSMENT PROGRAM
FOR
U.S. STEEL CORPORATION'S LORAIN WORKS
LORAIN, OHIO

INTRODUCTION

Lorain Works is an integrated steelmaking and fabrication facility. Production elements are blast furnaces, coke ovens, a by-products plant, a basic oxygen steelmaking facility and equipment for the manufacture of medium diameter steel tubes and pipe. Also produced at the plant is burnt lime, which is utilized solely at Lorain Works.

An on-site hazardous waste disposal landfill (EPA I.D. No. OHD 004222030) is used to dispose of hazardous wastes generated at the plant. This site, herein referred to as Site D-2, is listed under the Part A permit application as receiving the following hazardous wastes:

Waste Type	EPA Hazardous Waste Code Number
Chromate Filter Cake	D007
Decanter Tank Tar Sludge	K087
Leaded Steel Grinder Dust	D008

In reality, however, chromate filter cakes have never been placed in this landfill. Also, decanter tank tar sludge disposal has been greatly reduced since early 1983 because U.S. Steel has entered into an agreement with a contractor to haul this material offsite. The contractor, Petar, uses the decanter sludge as part of an energy recycling operation. Thus, only minor quantities of materials classified as hazardous presently are being deposited in Site D-2.

The landfill is situated along the western side of the Black River (approximately River Mile 5.5 to River Mile 5.7). This facility is defined by the east face of a bluff overlooking the river and a 40-foot-high embankment which parallels the river's edge and ties into the bluff. Figure 1 shows that the landfill is crescent-shaped. The

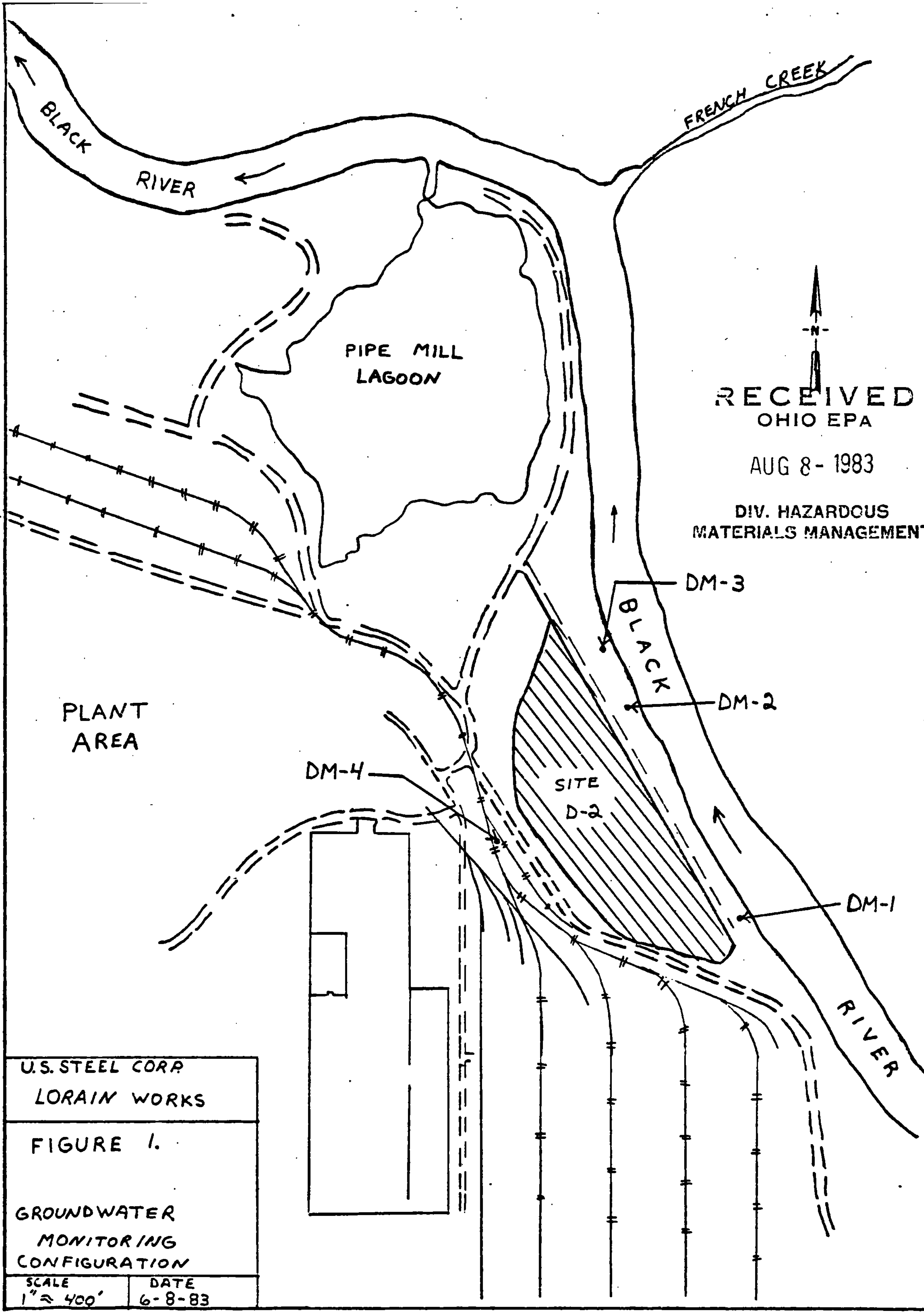

FIGURE 1.
GROUNDWATER MONITORING CONFIGURATION

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dimensions of the landfill are approximately 1000 feet long at the base and 275 feet at its widest point. Its capacity is estimated to range from 129,000 cubic yards (cy) to 161,000 cy and will cover approximately 4.5 acres when completed.

A groundwater monitoring system consisting of one upgradient and three downgradient wells was installed during September, 1981. Well locations are depicted on Figure 1 and pertinent data concerning each well are presented in Table 1.

Quarterly monitoring at these wells was conducted on November 19, 1981, February 17, 1982, June 3, 1982 and September 14, 1982 as specified by the Ohio EPA Hazardous Waste Rule 3745-65-92. The first semiannual sampling was conducted on April 11 and 12, 1983. Results of this sampling indicated that statistical differences existed between the initial year upgradient conditions and the first semiannual conditions, based on the Students-t test at the 0.01 level of significance. Specifically, these differences were: pH for wells DM-2 and DM-3, specific conductance for wells DM-2, DM-3 and DM-4 and total organic carbon (TOC) for all four wells. Resampling performed on May 24, 1983, confirmed these results. Notification that Site D-2 may be affecting groundwater quality was made on June 27, 1983 to both Ohio EPA and the U.S. EPA.

Regulations require that a groundwater quality assessment program (GWQAP) be implemented when a hazardous waste facility may be affecting groundwater quality. United States Steel Corporation (USSC), in conjunction with its consultant, the Baker/TSA Division of Michael Baker, Jr., Inc., has developed a plan for meeting this requirement. This plan, when implemented, will provide the information necessary to inform regulatory agencies in the event that potential adverse environmental effects may be caused as a result of disposal at this facility. However, prior to presenting this plan, some relevant background information concerning the landfill and its setting are in order to document the rationale for the proposed GWQAP.

TABLE 1. USSC LORAIN WORKS MONITORING WELLS INFORMATION.

Well No.	Purpose	Elevation to Top of Well Casing (ft. MSL)	Well Depth (ft.)	Measured Static Water Level Elevation (ft. MSL)	Date of Measurement
DM-1	Downgradient	587.70	21.8	570.45	09/23/81
				573.70	10/19/81
				575.0	02/17/82
				574.7	06/03/82
				575.39	04/11/83
				575.23	05/23/83
DM-2	Downgradient	581.64	10.0	579.20	09/23/81
				578.20	10/19/81
				578.7	02/17/82
				578.4	06/03/82
				577.1	09/14/82
				578.72	04/11/83
				578.44	05/23/83
DM-3	Downgradient	583.91	8.5	580.90	09/23/81
				580.90	10/19/81
				581.3	02/17/82
				580.4	09/14/82
				581.12	04/11/83
				581.23	05/23/83
DM-4	Upgradient	625.31	20.0	617.40	09/23/81
				618.70	10/19/81
				619.9	02/17/82
				619.5	06/03/82
				619.0	09/14/82
				620.19	04/11/83
				619.84	05/23/83

BACKGROUND

Groundwater Conditions

Site D-2 is located in close proximity to the Black River, as shown on Figure 1. Examination of the static water levels measured between upgradient well DM-4 and the three downgradient wells (see Table 1) indicates that a steep hydraulic gradient ranging from approximately 0.048 ft/ft (vertical:horizontal) between DM-4 and DM-3 and 0.073 ft/ft between DM-4 and DM-2 exists in this area. Thus, it is most probable that all of the groundwater potentially affected by the landfill will flow toward and intercept the Black River and would not pose a threat to any groundwater supply source. Both the horizontal and vertical extent of any plume originating from the landfill probably will be confined by entry into the Black River between RM 5.5 and 5.7.

Groundwater flow rates as related to contributions to the flow in the Black River are known to be minimal. The U.S. EPA (1975) in their "Technical Support Document for Proposed NPDES Permit" for USSC's Lorain Works stated that "The Black River basin has limited groundwater storage; hence the river has relatively low sustained flows with extended periods of extremely low flow during dry weather periods." In this same document this fact was confirmed in both thermal and dissolved oxygen modelling studies of the Black River. Groundwater contributions were not included in the calculations, yet the model results reasonably portrayed measured field conditions. Thus, the contributions of any potential contaminants contained in groundwater affected by Site D-2 would be expected to be minimal, particularly in light of the magnitude of the discharge volume of the Black River in this area.

Black River Water Quality

Historically, the Black River has had poor water quality conditions. The U.S. EPA (1975) reports that surveys conducted prior to 1974 indicated violation of water quality standards for temperature, dissolved oxygen, ammonia, cyanide, phenolics and various metals. These excursions were reportedly due to both municipal and industrial discharges. In 1974, the U.S. EPA conducted two intensive surveys of the river, which included sites upstream from the present location of the hazardous waste landfill (above RM 5.7). These surveys identified the Elyria sewage treatment plant (STP) as degrading water quality for numerous parameters including ammonia, dissolved oxygen, cyanides, chemical oxygen demand, total organic carbon (TOC) and biochemical oxygen demand (BOD), chromium, copper and zinc. The U.S. EPA also conducted a follow-up survey during July of 1979 which is reported in "Black River Waste Load Allocation Report, Volume II, Water Quality and Effluent Data" (U.S. EPA, undated). The closest upstream station to the present location of Site D-2 was at RM 6.50. Some of the pertinent results of that survey were:

Ammonia-N	2.86-3.25 mg/l
Cyanide	17-31 μg/l
Phenolics	4-5 μg/l
Barium	70-257 μg/l
Chromium	11-16 μg/l
Copper	12-14 μg/l
Iron	660-1080 μg/l
Lead	<15 μg/l
Nickel	<5-46 μg/l
Zinc	<50-76 μg/l

More recently, data collected by the Ohio EPA at Ford Road on the Black River (RM 9.8) for Water Years 1980, 1981 and 1982 indicate that the river section upstream from Site D-2 still experiences frequent violations of ammonia, total copper, total iron, and fecal coliform and occasional violation of phenolics and zinc water quality standards. The data collected by the Ohio EPA at Ford Road is provided as Attachment 1 to this report.

Effects of Site D-2 on Black River Water Quality

During the summer and early fall of 1982 the Ohio EPA conducted an extensive survey of the Black River. Included in this survey were water quality analyses of samples collected downstream (RM 5.4) and upstream

(RM 6.2 and RM 9.8) of Site D-2 (RM 5.5-5.7). Table 2 provides a side-by-side comparison of some of the data gathered during this period. Of particular importance are the parameters lead, phenols and naphthalene because the wastes managed at Site D-2 (leaded steel grinder dust and decanter tank tar sludge) are classified as hazardous on the basis of their content of these constituents. Values for lead, phenols and naphthalene were almost always near or below detection limits at the water quality sampling site just downstream from USSC's landfill. The organic priority pollutants benzene and benzo (a) pyrene were found to be below detection limits for each sample taken at the same downstream station (RM 5.4). Thus it appears that for the period in which Ohio EPA conducted their 1982 survey, Site D-2 did not adversely affect Black River water quality through contributions of any toxic organic or inorganic chemical parameters.

As mentioned previously, statistically higher values of specific conductance were noted for downgradient wells at the waste management site. This finding indicates that a source of total dissolved solids (TDS) exists which is entering the groundwater system. However, examination of TDS values for the Black River above and below Site D-2 (see Table 2) shows that TDS concentrations in the river were not consistently higher downstream of the site as would be expected if substantial groundwater flow rates occurred in this area. Thus, the U.S. EPA's conclusion that minimal groundwater flow enters the Black River appears to be confirmed, at least in this situation.

<u>Fisheries Data in the Vicinity of Site D-2</u>

In conjunction with their extensive water quality survey, Ohio EPA also collected fisheries data on the Black River. Use of such data to hypothesize what long-term water quality conditions are is questionable due to mobility of the fish and the selective nature of sampling gear. However, fisheries data can be an indicator of severe environmental stress. Ohio EPA sampled fish populations both downstream of the site at RM 4.8 and just upstream (RM 5.8). The data collected from these locations are provided as Attachment 2. Comparison on a "distance

TABLE 2. OHIO EPA 1982 WATER QUALITY DATA COLLECTED UPSTREAM AND DOWNSTREAM OF USSC SITE D-2 (RM 5.5-5.7).

PARAMETER	DATE	LOCATION BY RIVERMILE		
		RM 6.2	RM 5.4	
			Surface	Bottom
pH (SU)	8/5	7.5	7.5	7.4
	8/19	7.8	8.1	8.1
	8/26	7.6	7.7	7.7
	9/1	7.6	7.7	7.7
	9/8	7.5	7.9	7.6
	9/15	--	7.8	7.4
	9/22	7.7	--	--
	9/29	8.2	--	--
	10/6	7.6	--	--
	10/26	7.7	--	--
	10/27	--	7.8	7.8
Total Diss. Solids (mg/1)	8/5	464	448	444
	8/19	482	534	538
	8/26	588	526	530
	9/1	646	612	612
	9/8	574	720	698
	9/15	--	398	402
	9/22	554	--	--
	9/29	476	--	--
	10/6	634	--	--
	10/26	740	--	--
	10/27	--	704	720
BOD_5 (mg/1)	8/5	6.1	9.0	9.0
	8/19	11.0	12.0	13.0
	8/26	15.0	11.0	14.0
	9/1	11.0	14.0	15.0
	9/8	21.0	34.0	20.0
	9/15	--	5.2	1.2
	9/22	16.0	--	--
	9/29	3.0	--	--
	10/6	7.8	--	--
	10/26	5.8	--	--
	10/27	--	9.0	6.8

TABLE 2. OHIO EPA 1982 WATER QUALITY DATA COLLECTED UPSTREAM AND DOWNSTREAM OF USSC SITE D-2 (RM 5.5-5.7). (Continued)

PARAMETER	DATE	LOCATION BY RIVERMILE		
		RM 6.2	RM 5.4	
			Surface	Bottom
Ammonia Nitrogen (mg/l)	8/5	1.60	1.33	1.36
	8/19	7.40*	5.25*	5.15*
	8/26	10.40*	4.65*	9.35*
	9/1	15.90*	12.20*	13.30*
	9/8	14.10*	11.60*	12.30*
	9/15	--	2.03	2.16
	9/22	19.50*	--	--
	9/29	2.07*	--	--
	10/6	10.30*	--	--
	10/26	15.00*	--	--
	10/27	--	12.75*	14.00*
Total Iron (mg/l)	8/5	0.48	0.56	0.56
	8/19	0.52	1.53*	1.01*
	8/26	0.68	0.54	0.74
	9/1	0.52	0.77	1.06*
	9/8	0.92	1.09*	0.83
	9/15	--	0.74	0.76
	9/22	0.57	--	--
	9/29	0.57	--	--
	10/6	0.56	--	--
	10/26	0.64	--	--
	10/27	--	0.90	0.99
Total Chromium (mg/l)	8/5	<0.03	<0.03	<0.03
	8/19	<0.03	<0.03	<0.03
	8/26	<0.03	<0.03	<0.03
	9/1	<0.03	<0.03	<0.03
	9/8	<0.03	<0.03	<0.03
	9/15	--	<0.03	<0.03
	9/22	<0.03	--	--
	9/29	<0.03	--	--
	10/6	<0.03	--	--
	10/26	<0.03	--	--
	10/27	--	<0.03	<0.03

TABLE 2. OHIO EPA 1982 WATER QUALITY DATA COLLECTED UPSTREAM AND DOWNSTREAM OF USSC SITE D-2 (RM 5.5-5.7).
(Continued)

PARAMETER	DATE	LOCATION BY RIVERMILE		
		RM 6.2	RM 5.4	
			Surface	Bottom
Total Lead (µg/l)	8/5	4	4	3
	8/19	4	7	3
	8/26	4	2	5
	9/1	<2	2	--
	9/8	2	7	6
	9/15	--	6	5
	9/22	4	--	--
	9/29	5	--	--
	10/6	3	--	--
	10/26	<2	--	--
	10/27	--	5	2
Total Zinc (µg/l)	8/5	15	15	20
	8/19	30	95	65
	8/26	40	25	35
	9/1	25	55	50
	9/8	<10	35	25
	9/15	--	55	50
	9/22	25	--	--
	9/29	30	--	--
	10/6	60	--	--
	10/26	40	--	--
	10/27	--	45	40

	Date	RM 9.8	RM 5.4
Cyanide (mg/l)	8/5	--	--
	8/5	--	--
	8/19	0.01	<0.01
	8/19	--	<0.01
	8/26	<0.01	<0.01
	8/26	--	<0.01
	9/1	0.01	<0.01
	9/1	--	<0.01
	9/8	0.02	<0.01
	9/8	--	<0.01
	9/15	<0.01	0.01
	9/15	--	0.01
	9/22	0.01	--
	9/29	<0.01	--
	10/6	0.01	--
	10/26	0.09	--
	10/27	--	<0.01
	10/27	--	<0.01

TABLE 2. OHIO EPA 1982 WATER QUALITY DATA COLLECTED UPSTREAM AND DOWNSTREAM OF USSC SITE D-2 (RM 5.5-5.7). (Continued)

PARAMETER	DATE	LOCATION BY RIVERMILE	
		RM 9.8	RM 5.4
Phenols (μg/l)	8/19	12*	<10
	8/26	<10	<10
	9/1	16*	<10
	9/8	15*	<10
	9/15	<10	<10
	9/22	<10	--
	9/29	<10	--
	10/6	10	--
	10/26	<10	--
	10/27	--	16*
	10/27	--	24*
COD (mg/l)	8/5	35.0	60.0
	8/5		57.0
	8/19	57.0	57.0
	8/19		49.0
	8/26	62.0	37.0
	8/26		42.0
	9/1	75.0	49.0
	9/1		56.0
	9/8	65.0	51.0
	9/8		45.0
	9/15	45.0	41.0
	9/15		40.0
	9/22	53.0	--
	9/29	24.0	--
	10/6	58.0	--
	10/26	51.0	--
	10/27	--	42.0
	10/27	--	39.0
Benzo (a) pyrene (μg/l)	8/5	<10	<10
	8/19	<10	<10
	8/26	<10	--
	9/1	<10	--
	9/8	<10	<10
	9/15	<10	<10
	9/22	<10	--
	9/29	<10	--
	10/6	<10	--
	10/26	<10	--
	10/27	--	<10

TABLE 2. OHIO EPA 1982 WATER QUALITY DATA COLLECTED UPSTREAM AND DOWNSTREAM OF USSC SITE D-2 (RM 5.5-5.7). (Continued)

PARAMETER	DATE	LOCATION BY RIVERMILE	
		RM 9.8	RM 5.4
Benzene (µg/l)	8/5	<0.5	<0.5
	8/19	<0.5	<0.5
	8/26	<0.5	--
	9/1	<1.0	--
	9/8	<1.0	<0.5
	9/15	<1.0	<1.0
	9/22	<1.0	--
	9/29	<1.0	--
	10/6	<1.0	--
	10/26	<1.0	--
	10/27	--	<1.0
Naphthalene (µg/l)	8/5	<10	<10
	8/19	<10	<10
	8/26	<10	--
	9/1	<10	--
	9/8	<10	<10
	9/15	<10	<10
	9/22	<10	--
	9/29	<10	--
	10/6	<10	--
	10/26	<10	--
	10/27	--	<10

* = violation of Ohio EPA warmwater habitat water quality standard

fished" basis shows that the number of species, mean number of individuals and mean weight per kilometer were higher downstream of the landfill. Gamefish collected below the site included white bass (Morone chrysops), white perch (Morone americana), pumpkinseed (Lepomis gibbosus), largemouth bass (Micropterus salmoides) and bluegill (Lepomis macrochirus), all of which would typically be expected in a Great Lakes warmwater tributary habitat. Upstream of the site, gamefish captured were white bass, white perch and yellow perch (Perca flavescens). The mean number of gamefish per kilometer below Site D-2 was 45.75, while above the landfill in the river, 5.00 gamefish per kilometer were collected. Although these data are probably more an indication of the habitat types available for fish than anything else, they do suggest that both the fisheries quality and overall fish population has not been threatened by the presence of USSC's hazardous waste landfill.

Groundwater Quality at Site D-2

Tables 3 and 4 respectively present the initial year and second year groundwater sampling results from the monitoring program at the USSC hazardous waste management facility. Two major differences exist between the sampling techniques utilized for the initial year (Table 3) versus the second year (Table 4) monitoring. First, during the initial year the sampling crew used a bailer. However, all of the monitoring wells were constructed using galvanized iron couplings and two (DM-1 and DM-4) have lengths of galvanized black iron pipe. Since the wells were completed, oxidation of the iron has occurred and when the bailers were used to sample they tended to loosen the rust and contaminate the samples. However, prior to conducting the second year sampling, tygon tubing was installed in each of the wells and samples collected with a peristaltic pump so that the walls of the casing remained undisturbed. The second modification to sampling during the second year monitoring was that immediately after sample collection the samples were filtered through 0.45μ membrane filters, then preserved using the appropriate U.S. EPA recommended methods. The rationale for this change was that

SUMMARY OF INITIAL YEAR DATA (SR-1) REPORT DATE: 01 AUG 83

TABULATION OF PARAMETERS BY FACILITY, SITE, SAMPLING POINT, AND SAMPLING ROUND

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*---------------------------------------------------------*
|                    *                              *     |
|                  * *(+)DM-3                       ***    |
|                 *    * (DWGD)                    * * *   |
|                *      *                            *     |
|                *       *(+)DM-2                    *     |
|                *        * (DWGD)                   *     |
|                *         *                       NORTH   |
|       DM-4(+)  *          *                              |
|       (UPGD)   *    D-2    *                             |
|                 *           *                            |
|                  **          *(+)DM-1                    |
|                    **         * (DWGD)                   |
|------------|        ***       *                         |
|  MILL      |           ********                         |
|            |                                             |
*-------------- LORAIN WORKS * D-2 -----------------------*
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CLIENT: U.S. STEEL CORPORATION
FACILITY: LORAIN WORKS
LOCATION: LORAIN, OHIO

SITE: D-2 SAMPLING POINT: DM-1
TYPE: WELL DOWNGRADIENT

PARAMETER	UNITS	REGULATORY LIMIT	FIRST ROUND 11/19/81	SECOND ROUND 02/17/82	THIRD ROUND 06/03/82	FOURTH ROUND 09/14/82	MEAN	VARIANCE
ARSENIC	MG/L	0.05	.006	.003	.026	LT.002		
BARIUM	MG/L	1.0	2.	LT1.	LT.8	LT.1		
CADMIUM	MG/L	0.01	LT.01	LT.01	LT.001	LT.01		
CHROMIUM	MG/L	0.05	LT.02	LT.02	LT.03	LT.02		
FLUORIDE	MG/L	1.4-2.4	.5	.27	.36	.49		
LEAD	MG/L	0.05	LT.1	LT.04	.006	LT.05		
MERCURY	MG/L	0.002	.007	LT.001	LT.0002	LT.001		
NITRATE	MG/L	10.	LT.01	LT.01	.42	LT.01		
SELENIUM	MG/L	0.01	LT.002	LT.002	LT.005	LT.002		
SILVER	MG/L	0.05	LT.01	LT.01	LT.01	LT.02		
ENDRIN	MG/L	0.0002	LT.0001	LT.0001	LT.0001	LT.0001		
LINDANE	MG/L	0.004	LT.0001	LT.0001	LT.002	LT.0001		
METHOXYCHLOR	MG/L	0.1	LT.0005	LT.0005	LT.05	LT.0005		
TOXAPHENE	MG/L	0.005	LT.0005	LT.001	LT.0025	LT.001		
2,4-D	MG/L	0.1	LT.0001	LT.0001	LT.05	LT.001		
2,4,5-TP (SILVEX)	MG/L	0.01	LT.0004	LT.	LT.005	LT.0005		
RADIUM	PCI/L	5.	LT3.	LT5.	NO DATA	LT5.		
GROSS ALPHA	PCI/L	15.	LT5.	LT5.	LT3.	LT5.		
GROSS BETA	PCI/L	*	LT50.	LT15.	7.0+/-2.5	15.		
TOTAL COLIFORM	CO/100ML	1.0	24.	LT1.	10.	220.		
CHLORIDE	MG/L		80.	63.	70.	65.		
IRON	MG/L		78.	50.	77.	.12		
MANGANESE	MG/L		4.	2.	2.3	2.2		
PHENOLS	MG/L		LT.01	LT.01	.02	LT.01		
SODIUM	MG/L		80.	52.	470.	36.		
SULFATE	MG/L		510.	540.	49.	440.		
PH	SU		NO DATA	7.	6.5	6.5		
PH	SU		NO DATA	NO DATA	NO DATA	NO DATA		
PH	SU		NO DATA	NO DATA	NO DATA	NO DATA		
PH	SU		NO DATA	NO DATA	NO DATA	NO DATA	6.6667E+00	8.3333E-02
SPECIFIC CONDUCTANCE	UMHOS/CM		1080.	1050.	1180.	1100.		
SPECIFIC CONDUCTANCE	UMHOS/CM		NO DATA	NO DATA	NO DATA	NO DATA		
SPECIFIC CONDUCTANCE	UMHOS/CM		NO DATA	NO DATA	NO DATA	NO DATA		
SPECIFIC CONDUCTANCE	UMHOS/CM		NO DATA	NO DATA	NO DATA	NO DATA	1.1025E+03	3.0917E+03
TOTAL ORGANIC CARBON	MG/L		26.	10.	11.	13.		
TOTAL ORGANIC CARBON	MG/L		NO DATA	NO DATA	NO DATA	NO DATA		
TOTAL ORGANIC CARBON	MG/L		NO DATA	NO DATA	NO DATA	NO DATA		

TABLE 3 (Cont'd)

SUMMARY OF INITIAL YEAR DATA (SR-1)   REPORT DATE: 01 AUG 83

TABULATION OF PARAMETERS BY FACILITY, SITE, SAMPLING POINT, AND SAMPLING ROUND

```
*--------------------------------------------------*
|                *                             *   |
|              * *(+)DM-3                      ***  |
|             *     * (DWGD)                  * * * |
|            *      *                           *   |
|            *        *(+)DM-2                  *   |
|            *         * (DWGD)                 *   |
|            *          *                     NORTH |
|   DM-4(+)  *           *                          |
|   (UPGD)   *    D-2     *                         |
|             *             *                       |
|              **            *(+)DM-1               |
|                **           * (DWGD)              |
|-----------|      ***        *                      |
| MILL      |         ********                       |
|           |                                        |
*-------------- LORAIN WORKS * D-2 ----------------*
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CLIENT: U.S. STEEL CORPORATION
FACILITY: LORAIN WORKS
LOCATION: LORAIN, OHIO

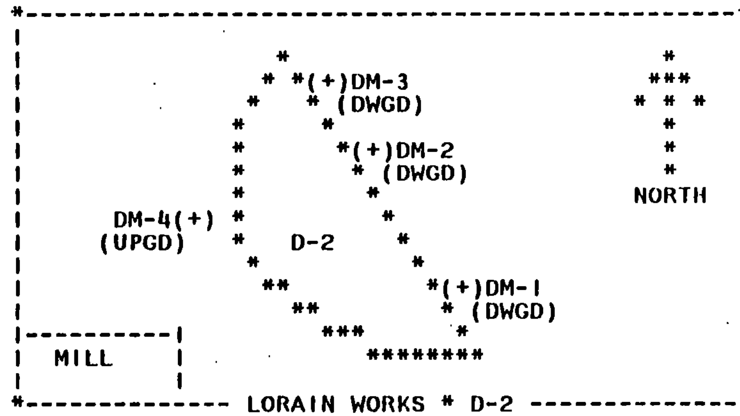
SITE: D-2   SAMPLING POINT: DM-1
                         TYPE: WELL   DOWNGRADIENT

PARAMETER	UNITS	REGULATORY LIMIT	FIRST ROUND 11/19/81	SECOND ROUND 02/17/82	THIRD ROUND 06/03/82	FOURTH ROUND 09/14/82	MEAN	VARIANCE
TOTAL ORGANIC CARBON	MG/L		NO DATA	NO DATA	NO DATA	NO DATA	1.5000E+01	5.5333E+01
TOTAL ORGANIC HALOGEN	MG/L		LT.356	LT.86	.129	LT.552		
TOTAL ORGANIC HALOGEN	MG/L		NO DATA	NO DATA	NO DATA	NO DATA		
TOTAL ORGANIC HALOGEN	MG/L		NO DATA	NO DATA	NO DATA	NO DATA		
TOTAL ORGANIC HALOGEN	MG/L		NO DATA	NO DATA	NO DATA	NO DATA	4.7425E-01	9.6010E-02
GROUND WATER ELEVATION	FT MSL		NO DATA	575.	574.7	573.7		
TEMPERATURE	C		NO DATA	NO DATA	NO DATA	NO DATA		
SOLIDS, DISS. - TDS	MG/L		NO DATA	NO DATA	1060.	NO DATA		
NAPHTHALENE	UG/L		NO DATA	NO DATA	NO DATA	NO DATA		

TABLE 3 (Cont'd)

SUMMARY OF INITIAL YEAR DATA (SR-1) REPORT DATE: 01 AUG 83

TABULATION OF PARAMETERS BY FACILITY, SITE, SAMPLING POINT, AND SAMPLING ROUND



CLIENT: U.S. STEEL CORPORATION
FACILITY: LORAIN WORKS
LOCATION: LORAIN, OHIO

SITE: D-2 SAMPLING POINT: DM-2
TYPE: WELL DOWNGRADIENT

PARAMETER	UNITS	REGULATORY LIMIT	FIRST ROUND 11/19/81	SECOND ROUND 02/17/82	THIRD ROUND 06/03/82	FOURTH ROUND 09/14/82	MEAN	VARIANCE
ARSENIC	MG/L	0.05	.008	.04	.05	.008		
BARIUM	MG/L	1.0	4.	LT1.	LT.8	LT.1		
CADMIUM	MG/L	0.01	LT.01	LT.01	LT.001	LT.01		
CHROMIUM	MG/L	0.05	.19	LT.02	.03	.03		
FLUORIDE	MG/L	1.4-2.4	3.4	4.	3.1	2.6		
LEAD	MG/L	0.05	.18	LT.04	.007	LT.05		
MERCURY	MG/L	0.002	.004	LT.001	LT.0002	LT.001		
NITRATE	MG/L	10.	LT.01	LT.01	.2	LT.01		
SELENIUM	MG/L	0.01	LT.002	.003	.007	LT.002		
SILVER	MG/L	0.05	LT.01	LT.01	LT.01	LT.02		
ENDRIN	MG/L	0.0002	LT.0001	LT.0001	LT.0001	LT.0001		
LINDANE	MG/L	0.004	LT.0001	LT.0001	LT.002	LT.0001		
METHOXYCHLOR	MG/L	0.1	LT.0005	LT.0005	LT.05	LT.0005		
TOXAPHENE	MG/L	0.005	LT.0005	LT.001	LT.0025	LT.001		
2,4-D	MG/L	0.1	LT.0001	LT.0001	LT.05	LT.001		
2,4,5-TP (SILVEX)	MG/L	0.01	LT.0004	LT.	LT.005	LT.0005		
RADIUM	PCI/L	5.	LT3.	LT5.	NO DATA	LT5.		
GROSS ALPHA	PCI/L	15.	LT5.	10.	LT.5	LT5.		
GROSS BETA	PCI/L	*	LT50.	50.	38.+/-3.	20.		
TOTAL COLIFORM	CO/100ML	1.0	2.	LT1.	LT1.	LT1.		
CHLORIDE	MG/L		550.	560.	600.	790.		
IRON	MG/L		96.	.12	2.8	42.		
MANGANESE	MG/L		4.4	LT.01	.12	.15		
PHENOLS	MG/L		1.	2.9	.42	.73		
SODIUM	MG/L		760.	480.	460.	400.		
SULFATE	MG/L		230.	230.	22.	210.		
PH	SU		NO DATA	10.4	10.3	9.6		
PH	SU		NO DATA	NO DATA	NO DATA	NO DATA		
PH	SU		NO DATA	NO DATA	NO DATA	NO DATA		
PH	SU		NO DATA	NO DATA	NO DATA	NO DATA	1.0100E+01	1.9000E-01
SPECIFIC CONDUCTANCE	UMHOS/CM		2300.	2050.	2400.	2900.		
SPECIFIC CONDUCTANCE	UMHOS/CM		NO DATA	NO DATA	NO DATA	NO DATA		
SPECIFIC CONDUCTANCE	UMHOS/CM		NO DATA	NO DATA	NO DATA	NO DATA		
SPECIFIC CONDUCTANCE	UMHOS/CM		NO DATA	NO DATA	NO DATA	NO DATA	2.4125E+03	1.2729E+05
TOTAL ORGANIC CARBON	MG/L		180.	73.	62.	79.		
TOTAL ORGANIC CARBON	MG/L		NO DATA	NO DATA	NO DATA	NO DATA		
TOTAL ORGANIC CARBON	MG/L		NO DATA	NO DATA	NO DATA	NO DATA		

TABLE 3 (Cont'd)

SUMMARY OF INITIAL YEAR DATA (SR-1) REPORT DATE: 01 AUG 83

TABULATION OF PARAMETERS BY FACILITY, SITE, SAMPLING POINT, AND SAMPLING ROUND

```
*---------------------------------------------------------*
|                  *                               *      |
|                 * *(+)DM-3                       ***     |
|                *    * (DWGD)                    * * *    |
|               *      *                            *      |
|               *       *(+)DM-2                    *      |
|               *         * (DWGD)                  *      |
|               *           *                     NORTH    |
|       DM-4(+) *             *                            |
|       (UPGD)  *     D-2      *                           |
|                *               *                         |
|                 **              *(+)DM-1                 |
|                   **             * (DWGD)                |
|-----------|        ***          *                       |
| MILL      |            ********                         |
|           |                                             |
*-------------- LORAIN WORKS * D-2 -----------------------*
```

CLIENT: U.S. STEEL CORPORATION
FACILITY: LORAIN WORKS
LOCATION: LORAIN, OHIO

SITE: D-2 SAMPLING POINT: DM-2
TYPE: WELL DOWNGRADIENT

PARAMETER	UNITS	REGULATORY LIMIT	FIRST ROUND 11/19/81	SECOND ROUND 02/17/82	THIRD ROUND 06/03/82	FOURTH ROUND 09/14/82	MEAN	VARIANCE
TOTAL ORGANIC CARBON	MG/L		NO DATA	NO DATA	NO DATA	NO DATA	9.8500E+01	3.0017E+03
TOTAL ORGANIC HALOGEN	MG/L		LT.356	LT.86	.148	LT.552		
TOTAL ORGANIC HALOGEN	MG/L		NO DATA	NO DATA	NO DATA	NO DATA		
TOTAL ORGANIC HALOGEN	MG/L		NO DATA	NO DATA	NO DATA	NO DATA		
TOTAL ORGANIC HALOGEN	MG/L		NO DATA	NO DATA	NO DATA	NO DATA	4.7900E-01	9.1727E-02
GROUND WATER ELEVATION	FT MSL		NO DATA	578.7	578.4	577.1		
TEMPERATURE	C		NO DATA	NO DATA	NO DATA	NO DATA		
SOLIDS, DISS. - TDS	MG/L		NO DATA	NO DATA	1760.	NO DATA		
NAPHTHALENE	UG/L		NO DATA	NO DATA	NO DATA	NO DATA		

SUMMARY OF INITIAL YEAR DATA (SR-1) REPORT DATE: 01 AUG 83

TABULATION OF PARAMETERS BY FACILITY, SITE, SAMPLING POINT, AND SAMPLING ROUND

```
*-----------------------------------------------------------*
|                              *                      *     |
|                            * *(+)DM-3               ***    |
|                           *   * (DWGD)             * * *   |
|                          *     *                     *     |
|                          *      *(+)DM-2             *     |
|                          *       * (DWGD)            *     |
|                          *        *                NORTH   |
|              DM-4(+)     *         *                       |
|              (UPGD)      *   D-2    *                      |
|                          *           *                     |
|                           **          *(+)DM-1             |
|                             **         * (DWGD)            |
|-----------|                  ***       *                  |
| MILL      |                     ********                  |
|           |                                               |
*------------- LORAIN WORKS * D-2 --------------------------*
```

CLIENT: U.S. STEEL CORPORATION
FACILITY: LORAIN WORKS
LOCATION: LORAIN, OHIO

SITE: D-2 SAMPLING POINT: DM-3
TYPE: WELL DOWNGRADIENT

PARAMETER	UNITS	REGULATORY LIMIT	FIRST ROUND 11/19/81	SECOND ROUND 02/17/82	THIRD ROUND 06/03/82	FOURTH ROUND 09/14/82	MEAN	VARIANCE
ARSENIC	MG/L	0.05	LT.004	.003	.017	LT.002		
BARIUM	MG/L	1.0	LT1.	LT1.	LT.8	LT.2		
CADMIUM	MG/L	0.01	LT.01	LT.01	.0013	LT.01		
CHROMIUM	MG/L	0.05	.028	LT.02	.12	LT.02		
FLUORIDE	MG/L	1.4-2.4	3.5	3.8	3.6	3.9		
LEAD	MG/L	0.05	.12	.048	.047	LT.05		
MERCURY	MG/L	0.002	.002	LT.001	LT.0002	LT.001		
NITRATE	MG/L	10.	.05	.7	LT.1	.17		
SELENIUM	MG/L	0.01	LT.002	.007	LT.005	.002		
SILVER	MG/L	0.05	.013	.014	LT.01	LT.02		
ENDRIN	MG/L	0.0002	LT.0001	LT.0001	LT.0001	LT.0001		
LINDANE	MG/L	0.004	LT.0001	LT.0001	LT.002	LT.0001		
METHOXYCHLOR	MG/L	0.1	LT.0005	LT.0005	LT.05	LT.0005		
TOXAPHENE	MG/L	0.005	LT.0005	LT.001	LT.0025	LT.001		
2,4-D	MG/L	0.1	LT.0001	LT.0001	LT.05	LT.001		
2,4,5-TP (SILVEX)	MG/L	0.01	LT.0004	LT.	LT.005	LT.0005		
RADIUM	PCI/L	5.	LT3.	LT5.	NO DATA	LT5.		
GROSS ALPHA	PCI/L	15.	LT5.	LT5.	LT10.	LT5.		
GROSS BETA	PCI/L	*	100.	50.	160.+/-20.	27.		
TOTAL COLIFORM	CO/100ML	1.0	LT1.	LT1.	LT1.	LT1.		
CHLORIDE	MG/L		730.	540.	850.	920.		
IRON	MG/L		3.6	.058	23.	84.		
MANGANESE	MG/L		.18	.016	2.3	LT.02		
PHENOLS	MG/L		2.2	.85	.89	1.4		
SODIUM	MG/L		810.	440.	570.	520.		
SULFATE	MG/L		440.	460.	350.	340.		
PH	SU		NO DATA	12.2	11.7	11.5		
PH	SU		NO DATA	NO DATA	NO DATA	NO DATA		
PH	SU		NO DATA	NO DATA	NO DATA	NO DATA		
PH	SU		NO DATA	NO DATA	NO DATA	NO DATA	1.1800E+01	1.3000E-01
SPECIFIC CONDUCTANCE	UMHOS/CM		4300.	6000.	8000.	7300.		
SPECIFIC CONDUCTANCE	UMHOS/CM		NO DATA	NO DATA	NO DATA	NO DATA		
SPECIFIC CONDUCTANCE	UMHOS/CM		NO DATA	NO DATA	NO DATA	NO DATA		
SPECIFIC CONDUCTANCE	UMHOS/CM		NO DATA	NO DATA	NO DATA	NO DATA	6.4000E+03	2.6467E+06
TOTAL ORGANIC CARBON	MG/L		64.	34.	40.	53.		
TOTAL ORGANIC CARBON	MG/L		NO DATA	NO DATA	NO DATA	NO DATA		
TOTAL ORGANIC CARBON	MG/L		NO DATA	NO DATA	NO DATA	NO DATA		

SUMMARY OF INITIAL YEAR DATA (SR-1) REPORT DATE: 01 AUG 83

TABULATION OF PARAMETERS BY FACILITY, SITE, SAMPLING POINT, AND SAMPLING ROUND

```
*---------------------------------------------------------------*
|                                                               |
|                 *                                     *        |
|               *  *(+)DM-3                            ***       |
|              *    * (DWGD)                          * * *      |
|             *      *                                  *        |
|             *         *(+)DM-2                        *        |
|             *          * (DWGD)                       *        |
|             *           *                           NORTH      |
|  DM-4(+)   *             *                                    |
|  (UPGD)    *     D-2       *                                  |
|             *                *                                 |
|              **                *(+)DM-1                        |
|                **               * (DWGD)                       |
|-----------|      ***           *                              |
| MILL      |         ********                                  |
|           |                                                   |
*------------- LORAIN WORKS * D-2 ------------------------------*
```

CLIENT: U.S. STEEL CORPORATION
FACILITY: LORAIN WORKS
LOCATION: LORAIN, OHIO

SITE: D-2 SAMPLING POINT: DM-3
TYPE: WELL DOWNGRADIENT

PARAMETER	UNITS	REGULATORY LIMIT	FIRST ROUND 11/19/81	SECOND ROUND 02/17/82	THIRD ROUND 06/03/82	FOURTH ROUND 09/14/82	MEAN	VARIANCE
TOTAL ORGANIC CARBON	MG/L		NO DATA	NO DATA	NO DATA	NO DATA	4.7750E+01	1.8025E+02
TOTAL ORGANIC HALOGEN	MG/L		LT.356	LT.86	.168	LT.552		
TOTAL ORGANIC HALOGEN	MG/L		NO DATA	NO DATA	NO DATA	NO DATA		
TOTAL ORGANIC HALOGEN	MG/L		NO DATA	NO DATA	NO DATA	NO DATA		
TOTAL ORGANIC HALOGEN	MG/L		NO DATA	NO DATA	NO DATA	NO DATA	4.8400E-01	8.7413E-02
GROUND WATER ELEVATION	FT MSL		NO DATA	581.3	580.9	580.4		
TEMPERATURE	C		NO DATA	NO DATA	NO DATA	NO DATA		
SOLIDS, DISS. - TDS	MG/L		NO DATA	NO DATA	4700.	NO DATA		
NAPHTHALENE	UG/L		NO DATA	NO DATA	NO DATA	NO DATA		

SUMMARY OF INITIAL YEAR DATA (SR-1) REPORT DATE: 01 AUG 83

TABULATION OF PARAMETERS BY FACILITY, SITE, SAMPLING POINT, AND SAMPLING ROUND

```
*----------------------------------------------------------------*
|                                                                 |
|                       *                                     *   |
|                     * *(+)DM-3                             ***  |
|                   *     * (DWGD)                          * * * |
|                  *        *                                 *   |
|                  *          *(+)DM-2                        *   |
|                  *            * (DWGD)                      *   |
|                  *              *                        NORTH  |
|        DM-4(+)   *                *                             |
|        (UPGD)    *      D-2         *                           |
|                   *                   *                         |
|                    **                   *(+)DM-1                |
|                      **                   * (DWGD)              |
|-------------|         ***               *                      |
|  MILL       |            ********                              |
|             |                                                   |
*------------- LORAIN WORKS * D-2 --------------------------------*
```

CLIENT: U.S. STEEL CORPORATION
FACILITY: LORAIN WORKS
LOCATION: LORAIN, OHIO

SITE: D-2 SAMPLING POINT: DM-4
TYPE: WELL UPGRADIENT

PARAMETER	UNITS	REGULATORY LIMIT	FIRST ROUND 11/19/81	SECOND ROUND 02/17/82	THIRD ROUND 06/03/82	FOURTH ROUND 09/14/82	MEAN	VARIANCE
ARSENIC	MG/L	0.05	LT.004	.007	.006	LT.002		
BARIUM	MG/L	1.0	2.	LT1.	LT.8	LT.1		
CADMIUM	MG/L	0.01	.01	LT.01	.0014	LT.01		
CHROMIUM	MG/L	0.05	.056	LT.02	LT.03	LT.02		
FLUORIDE	MG/L	1.4-2.4	.6	.73	.27	.55		
LEAD	MG/L	0.05	.13	LT.04	.011	LT.05		
MERCURY	MG/L	0.002	.002	LT.001	.0002	LT.001		
NITRATE	MG/L	10.	LT.01	LT.01	.32	LT.01		
SELENIUM	MG/L	0.01	LT.002	LT.002	LT.005	LT.002		
SILVER	MG/L	0.05	LT.01	.012	LT.01	LT.02		
ENDRIN	MG/L	0.0002	LT.0001	LT.0001	LT.0001	LT.0001		
LINDANE	MG/L	0.004	LT.0001	LT.0001	LT.002	LT.0001		
METHOXYCHLOR	MG/L	0.1	LT.0005	LT.0005	LT.05	LT.0005		
TOXAPHENE	MG/L	0.005	LT.0005	LT.001	LT.0025	LT.001		
2,4-D	MG/L	0.1	LT.0001	LT.0001	LT.05	LT.001		
2,4,5-TP (SILVEX)	MG/L	0.01	LT.0004	LT.	LT.005	LT.0005		
RADIUM	PCI/L	5.	LT3.	LT5.	NO DATA	LT5.		
GROSS ALPHA	PCI/L	15.	LT5.	LT5.	LT5.	LT5.		
GROSS BETA	PCI/L	*	LT50.	LT15.	16.+/-4.	LT8.		
TOTAL COLIFORM	CO/100ML	1.0	61.	LT1.	LT1.	500.		
CHLORIDE	MG/L		88.	2.3	84.	78.		
IRON	MG/L		42.	1.3	31.	5.2		
MANGANESE	MG/L		7.4	4.	3.6	2.		
PHENOLS	MG/L		LT.01	LT.01	.018	.11		
SODIUM	MG/L		120.	70.	70.	34.		
SULFATE	MG/L		1200.	1400.	1020.	650.		
PH	SU		NO DATA	6.8	6.2	6.5		
PH	SU		NO DATA	NO DATA	NO DATA	NO DATA		
PH	SU		NO DATA	NO DATA	NO DATA	NO DATA		
PH	SU		NO DATA	NO DATA	NO DATA	NO DATA	6.5000E+00	9.0000E-02
SPECIFIC CONDUCTANCE	UMHOS/CM		1975.	2100.	2300.	1800.		
SPECIFIC CONDUCTANCE	UMHOS/CM		2000.	2100.	2300.	1800.		
SPECIFIC CONDUCTANCE	UMHOS/CM		2050.	2150.	2300.	1800.		
SPECIFIC CONDUCTANCE	UMHOS/CM		2100.	2200.	2300.	1900.	2.0734E+03	3.3289E+04
TOTAL ORGANIC CARBON	MG/L		15.	4.	7.	10.		
TOTAL ORGANIC CARBON	MG/L		22.	5.	9.	11.		
TOTAL ORGANIC CARBON	MG/L		25.	5.	8.	11.		

SUMMARY OF INITIAL YEAR DATA (SR-1) REPORT DATE: 01 AUG 83

TABULATION OF PARAMETERS BY FACILITY, SITE, SAMPLING POINT, AND SAMPLING ROUND

```
*---------------------------------------------------------*
|                    *                               *    |
|                   * *(+)DM-3                      ***   |
|                  *    * (DWGD)                   * * *  |
|                 *      *                            *   |
|                 *       *(+)DM-2                    *   |
|                 *        * (DWGD)                   *   |
|                 *          *                     NORTH |
|         DM-4(+) *            *                         |
|         (UPGD)  *    D-2       *                       |
|                  *               *                     |
|                   **              *(+)DM-1             |
|                     **              * (DWGD)           |
|-----------|          ***          *                   |
|  MILL     |             ********                      |
|           |                                           |
*-------------- LORAIN WORKS * D-2 ----------------------*
```

CLIENT: U.S. STEEL CORPORATION
FACILITY: LORAIN WORKS
LOCATION: LORAIN, OHIO

SITE: D-2 SAMPLING POINT: DM-4
TYPE: WELL UPGRADIENT

PARAMETER	UNITS	REGULATORY LIMIT	FIRST ROUND 11/19/81	SECOND ROUND 02/17/82	THIRD ROUND 06/03/82	FOURTH ROUND 09/14/82	MEAN	VARIANCE
TOTAL ORGANIC CARBON	MG/L		26.	5.	8.	11.	1.1375E+01	5.0117E+01
TOTAL ORGANIC HALOGEN	MG/L		.007	.003	.294	.004		
TOTAL ORGANIC HALOGEN	MG/L		.257	.004	.437	.424		
TOTAL ORGANIC HALOGEN	MG/L		.036	.057	.229	.069		
TOTAL ORGANIC HALOGEN	MG/L		.026	.012	.162	.544	1.6031E-01	3.3124E-02
GROUND WATER ELEVATION	FT MSL		NO DATA	619.9	619.5	619.		
TEMPERATURE	C		NO DATA	NO DATA	NO DATA	NO DATA		
SOLIDS, DISS. - TDS	MG/L		NO DATA	NO DATA	2080.	NO DATA		
NAPHTHALENE	UG/L		NO DATA	NO DATA	NO DATA	NO DATA		

MONITORING AT USSC LORAIN WORKS (SITE D-2).

SUMMARY REPORT - SAMPLING ROUND (SR-2)   REPORT DATE: 12 MAY 83

TABULATION OF RESULTS BY FACILITY, SITE,
AND SAMPLING POINT FOR SAMPLING ROUND

CLIENT: U.S. STEEL CORPORATION
FACILITY: LORAIN WORKS   LOCATION: LORAIN, OHIO
SITE: D-2
SAMPLING ROUND: 5

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*------------------------------------------------*
|                  *                          *   |
|                 * *(+)DM-3                 ***  |
|                *    * (DWGD)              * * * |
|               *      *                      *   |
|               *       *(+)DM-2              *   |
|               *        * (DWGD)             *   |
|               *         *                 NORTH |
|       DM-4(+) *          *                      |
|        (UPGD) *    D-2    *                     |
|                *           *                    |
|                 **          *(+)DM-1            |
|                   **         * (DWGD)           |
|-----------|        ***     *                   |
|  MILL     |          ********                  |
|           |                                     |
*-------------- LORAIN WORKS * D-2 ---------------*
```

PARAMETER	UNIT	REGULATORY LEVEL	DM-1 DOWNGRADIENT 04/12/83	DM-2 DOWNGRADIENT 04/12/83	DM-3 DOWNGRADIENT 04/12/83	DM-4 UPGRADIENT 04/11/83
			SAMPLING POINT, SAMPLE NO.			
ARSENIC	MG/L	0.05	0.007	LT0.001	0.009	LT0.001
BARIUM	MG/L	1.0	0.1	0.1	LT0.1	LT0.1
CADMIUM	MG/L	0.01	LT0.005	LT0.005	LT0.005	LT0.005
CHROMIUM	MG/L	0.05	LT0.01	LT0.01	0.01	0.01
FLUORIDE	MG/L	1.4-2.4	0.28	1.6	2.8	0.19
LEAD	MG/L	0.05	LT0.03	LT0.03	LT0.03	LT0.03
MERCURY	MG/L	0.002	LT0.0002	LT0.0002	LT0.0002	LT0.0002
NITRATE	MG/L	10.	0.28	0.55	1.1	LT0.1
SELENIUM	MG/L	0.01	LT0.002	LT0.002	0.011	LT0.002
SILVER	MG/L	0.05	LT0.01	LT0.01	LT0.01	LT0.01
PHENOLS	MG/L		LT0.01	0.9	0.79	LT0.01
PH	SU		6.9	11.6	12.4	6.7
PH	SU		6.9	11.5	12.4	6.7
PH	SU		6.8	11.6	12.4	6.7
PH	SU		6.8	11.6	12.4	6.6
SPECIFIC CONDUCTANCE	UMHOS/CM		1450.	2800.	7100.	2730.
SPECIFIC CONDUCTANCE	UMHOS/CM		1390.	2770.	7100.	2760.
SPECIFIC CONDUCTANCE	UMHOS/CM		1230.	2760.	7200.	2760.
SPECIFIC CONDUCTANCE	UMHOS/CM		1410.	2660.	7200.	2750.
TOTAL ORGANIC CARBON	MG/L		45.8	55.9	30.4	107.
TOTAL ORGANIC CARBON	MG/L		47.8	57.9	28.1	130.
TOTAL ORGANIC CARBON	MG/L		46.3	59.3	30.1	108.
TOTAL ORGANIC CARBON	MG/L		46.3	69.3	30.4	111.
TOTAL ORGANIC HALOGEN	UG/L		21.	148.	57.	25.
TOTAL ORGANIC HALOGEN	UG/L		14.	103.	47.	20.
TOTAL ORGANIC HALOGEN	UG/L		22.	112.	56.	20.
TOTAL ORGANIC HALOGEN	UG/L		21.	117.	41.	24.
GROUND WATER ELEVATION	FT MSL		575.39	578.72	581.12	620.19
TEMPERATURE	C		9.5	8.5	9.5	9.5
NAPHTHALENE	UG/L		LT10.	5.	94.	LT10.

SUMMARY REPORT - SAMPLING ROUND (SR-2)   REPORT DATE: 12 MAY 83

TABULATION OF RESULTS BY FACILITY, SITE,
AND SAMPLING POINT FOR SAMPLING ROUND

CLIENT: U.S. STEEL CORPORATION
FACILITY: LORAIN WORKS   LOCATION: LORAIN, OHIO
SITE: D-2
SAMPLING ROUND: 5

			SAMPLING POINT, SAMPLE NO.			
			DM-1	DM-2	DM-3	DM-4
			DOWNGRADIENT	DOWNGRADIENT	DOWNGRADIENT	UPGRADIENT
PARAMETER	UNIT	REGULATORY LEVEL	04/12/83	04/12/83	04/12/83	04/11/83
ACENAPHTHENE	UG/L		LT10.	LT10.	LT10.	LT10.
ACENAPHTHYLENE	UG/L		LT10.	LT10.	LT10.	LT10.
ANTHRACENE	UG/L		LT10.	LT10.	LT10.	LT10.
BENZIDINE	UG/L		LT40.	LT40.	LT40.	LT40.
BENZO (A) ANTHRACENE	UG/L		LT10.	LT10.	LT10.	LT10.
BENZO (A) PYRENE	UG/L		LT20.	LT20.	LT20.	LT20.
BENZO (B) FLUORANTHENE	UG/L		LT20.	LT20.	LT20.	LT20.
BENZO (G,H,I) PERYLENE	UG/L		LT20.	LT20.	LT20.	LT20.
BENZO (K) FLUORANTHENE	UG/L		LT20.	LT20.	LT20.	LT20.
BIS (2-CHLOROETHOXY) METHANE	UG/L		LT20.	LT20.	LT20.	LT20.
BIS (2-CHLOROETHYL) ETHER	UG/L		LT10.	LT10.	LT10.	LT10.
BIS (2-CHLOROISOPROPYL) ETHER	UG/L		LT20.	LT20.	LT20.	LT20.
BIS (2-ETHYLHEXYL) PHTHALATE	UG/L		LT10.	LT10.	LT10.	LT10.
4-BROMOPHENYL PHENYL ETHER	UG/L		LT10.	LT10.	LT10.	LT10.
BENZYL BUTYL PHTHALATE	UG/L		LT10.	LT10.	LT10.	LT10.
2-CHLORONAPHTHALENE	UG/L		LT10.	LT10.	LT10.	LT10.
4-CHLOROPHENYL PHENYL ETHER	UG/L		LT10.	LT10.	LT10.	LT10.
CHRYSENE	UG/L		LT20.	LT20.	LT20.	LT20.
DIBENZO (A,H) ANTHRACENE	UG/L		LT20.	LT20.	LT20.	LT20.
1,2-DICHLOROBENZENE	UG/L		LT10.	LT10.	LT10.	LT10.
1,3-DICHLOROBENZENE	UG/L		LT10.	LT10.	LT10.	LT10.
1,4-DICHLOROBENZENE	UG/L		LT10.	LT10.	LT10.	LT10.
3,3-DICHLOROBENZIDINE	UG/L		LT20.	LT20.	LT20.	LT20.
DIETHYL PHTHALATE	UG/L		LT10.	LT10.	LT10.	LT10.
DIMETHYL PHTHALATE	UG/L		LT10.	LT10.	LT10.	LT10.
DI-N-BUTYLPHTHALATE	UG/L		LT10.	LT10.	LT10.	LT10.
2,4-DINITROTOLUENE	UG/L		LT20.	LT20.	LT20.	LT20.
2,6-DINITROTOLUENE	UG/L		LT20.	LT20.	LT20.	LT20.
DI-N-OCTYPHTHALATE	UG/L		LT10.	LT10.	LT10.	LT10.
1,2-DIPHENYLHYDRAZINE	UG/L		LT20.	LT20.	LT20.	LT20.

SUMMARY REPORT - SAMPLING ROUND (SR-2)   REPORT DATE: 12 MAY 83

TABULATION OF RESULTS BY FACILITY, SITE,
AND SAMPLING POINT FOR SAMPLING ROUND

CLIENT: U.S. STEEL CORPORATION
FACILITY: LORAIN WORKS   LOCATION: LORAIN, OHIO
SITE: D-2
SAMPLING ROUND: 5

			SAMPLING POINT, SAMPLE NO.			
			DM-1	DM-2	DM-3	DM-4
		REGULATORY	DOWNGRADIENT	DOWNGRADIENT	DOWNGRADIENT	UPGRADIENT
PARAMETER	UNIT	LEVEL	04/12/83	04/12/83	04/12/83	04/11/83
FLUORANTHENE	UG/L		LT10.	LT10.	LT10.	LT10.
FLUORENE	UG/L		LT10.	LT10.	LT10.	LT10.
HEXACHLOROBENZENE	UG/L		LT10.	LT10.	LT10.	LT10.
HEXACHLOROBUTADIENE	UG/L		LT10.	LT10.	LT10.	LT10.
HEXACHLOROCYCLOPENTADIENE	UG/L		LT10.	LT10.	LT10.	LT10.
HEXACHLOROETHANE	UG/L		LT10.	LT10.	LT10.	LT10.
INDENO (1,2,3-CD) PYRENE	UG/L		LT20.	LT20.	LT20.	LT20.
ISOPHORONE	UG/L		LT10.	LT10.	LT10.	LT10.
NITROBENZENE	UG/L		LT10.	LT10.	LT10.	LT10.
N-NITROSODIMETHYLAMINE	UG/L		LT10.	LT10.	LT10.	LT10.
N-NITROSODI-N-PROPYLAMINE	UG/L		LT10.	LT10.	LT10.	LT10.
N-NITROSODIPHENYLAMINE	UG/L		LT10.	LT10.	LT10.	LT10.
PHENANTHRENE	UG/L		LT10.	LT10.	LT10.	LT10.
PYRENE	UG/L		LT10.	LT10.	LT10.	LT10.
1,2,4-TRICHLOROBENZENE	UG/L		LT10.	LT10.	LT10.	LT10.

only the dissolved fraction of the chemical constituents in groundwater will migrate from the site and thus are of use in establishing groundwater quality. Therefore, direct comparisons between values contained in Tables 3 and 4 are cautioned for many of the parameters measured and the validity of the results in Table 3, particularly for metals such as iron, is questionable.

In general, the groundwater both upgradient and downgradient from Site D-2 contains high concentrations of total dissolved solids as indicated by the specific conductance and major ions (sodium, chloride and sulfate). Well DM-3 is unquestionably higher in dissolved solids and reflects an input of dissolved material from either the landfill or an undefined source. This fact in itself does not necessarily relate to an adverse impact since the groundwater discharge is thought to be minimal and so the loading of dissolved solids to the Black River is most likely negligible, as shown previously in data for the Black River.

The pH values measured both for the initial and second year samplings also indicate that an alkaline source or sources are influencing groundwater as measured at wells DM-2 and DM-3. Again, however, this effect is not reflected in the water quality of the Black River.

Of greater interest are the results of drinking water parameter analyses (arsenic, barium, cadmium, chromium, fluoride, lead, mercury, nitrate, selenium, silver, endrin, lindane, methoxychlor, toxaphene, 2,4-D, 2,4,5-TP silvex, radium, gross alpha and gross beta). Measured values for these groundwater constituents have consistently been less than regulatory limits for all wells, especially for the results of the second year sampling with the exception of fluoride at wells DM-2 and DM-3. Fluoride concentrations at these wells have slightly exceeded the temperature-dependent limit.

Because the wastes disposed in Site D-2 are listed for lead, phenols and naphthalene, these parameters deserve close scrutiny in the groundwater monitoring results. Although not specifically required to measure naphthalene under interim status, U.S. Steel did have this compound as well as 45 other base-neutral extractable priority pollutants examined during the second year sampling. The results as shown in Table 4 indicate that lead and the 45 base-neutral priority pollutant levels were below detection limits. Naphthalene concentrations were below 10 μg/l for three of the four wells and phenols levels were less than 1 mg/l for all wells. Although measurable phenols and naphthalene concentrations were found at wells DM-2 and DM-3, their effect on Black River water quality was not measurable as shown in Table 2.

In summary, the groundwater monitoring data for Site D-2 seemingly does show some effects from the landfill, but when examined in conjunction with the water quality results collected by the Ohio EPA, groundwater migrating from the site to the river does not measurably degrade the water quality of the Black River.

Preliminary Hazard Assessment

Based on the almost certain assumption that all the groundwater migrating through Site D-2 enters the Black River and since no groundwater supply sources exist between the landfill and the river, then the only possible detrimental effect of potentially contaminated groundwater from the site would be on users of the Black River. Since the Black River downstream from Site D-2 does not serve as a public drinking water supply and is not used for contact recreation activities (i.e. bathing), the threat posed by this facility as a public health hazard is minimal. In fact, use of the Black River generally is confined to industrial water withdrawal, primarily by U.S. Steel. Coupled with the minor contribution of groundwater to the flow of the river, the hazard associated with this waste management site on the area appears to be insignificant.

ASSESSMENT PLAN

Given that the evidence discussed previously indicates that Site D-2 has little or no effect on Black River water quality, that no apparent human health hazard exists as a result of the operation of the facility, and that active hazardous waste disposal operations in the landfill have been greatly curtailed, U.S. Steel believes that maintenance of the present groundwater monitoring points with some modification in the analytical protocol will be sufficient to assess environmental conditions. Furthermore, the information generated through this increased monitoring program will provide the regulatory agencies with enough data to assure continued nondegradation of Black River water quality. The proposed assessment approach follows.

Sampling Locations

The location of the monitoring wells will remain the same as shown in Figure 1. Installation of more monitoring wells is not planned due to the close proximity to the Black River and the steep bluffs along the river located north and south of the facility which limit placement of additional monitoring sites.

Sampling Frequency

Because groundwater flow discharges are considered to be minimal in the Black River basin, semiannual sampling should be sufficient to monitor possible changes in the quality of groundwater entering the Black River. Should substantial changes in quality occur, then the frequency of monitoring will be increased accordingly.

Sampling Parameters

The following parameters will be monitored on a semiannual basis. Their selection reflects the types of wastes managed at the facility, constituents that previously have been detected in the monitoring program, and parameters that have been selected by the U.S. EPA as being of concern in groundwater protection.

Groundwater Indicator Parameters

- pH
- Specific Conductance
- Total Organic Carbon
- Total Organic Halogens

Groundwater Quality Parameters

- Chloride
- Iron
- Manganese
- Phenols
- Sodium
- Sulfate

Selected Drinking Water Parameters

- Arsenic
- Barium
- Cadmium
- Chromium
- Fluoride
- Lead
- Mercury
- Nitrate-N
- Selenium
- Silver

Other

- Base Neutral Extractable Priority Pollutants (including naphthalene)
- Static water level

A manual developed for the Lorain Works groundwater monitoring program that addresses sampling procedures, sample handling and preservation, chain-of-custody, recordkeeping, analytical methods and the quality control process has been prepared by U.S. Steel's consultant, Baker/TSA, and is presented as Attachment 3.

Reporting

To alleviate agency concerns regarding potential degradation of groundwater quality, U.S. Steel will submit routine reports of the results of each sampling of the groundwater monitoring system within 30 days after obtaining sampling results. Should long-term monitoring indicate that groundwater conditions remain stable or improve, then consideration should be given to decreasing reporting to a once-a-year event to reduce the time expended, and the associated cost and paperwork.

Data generated from the groundwater monitoring program as proposed herein for USSC Lorain Works hazardous waste management facility will provide a reasonably accurate assessment of site conditions. In addition, this program will continue to serve as an early detection system and should the groundwater quality significantly deteriorate, allow sufficient time for the development and implementation of remedial actions before significant environmental harm can occur.

Attachment 1

OHIO EPA WATER QUALITY SUMMARIES FOR THE BLACK RIVER AT FORD ROAD (WATER YEARS 1980-1982)

STATION: Black River @ Ford Rd STORET CODE: 501510 USE DESIGNATION: LWH

Date	PH, Field S.U.	Dissolved Oxygen mg/l	Conductivity; Field u mho/cm	Flow, Instantaneous CFS	Water Temperature °C	Turbidity F.T.U.	Alkalinity, Total as $CaCO_3$ - mg/l	Hardness, Total as $CaCO_3$ - mg/l	Suspended Solids mg/l	Dissolved Solids mg/l	Sulfate, SO_4 mg/l	Nitrogen TKN mg/l	Nitrogen Ammonia mg/l	Nitrate mg/l	Nitrite mg/l
10-22-79	7.4	6.1	910		17.0		193	278	<10	410	143	7.9	5.91	1.23	<0.01
11-6-79	7.6	6.9	800		8.0	3.0	203	300	<10	592	156	6.29	5.51	0.16	0.26
12-5-79	7.6	13.8	1050		1.0	7.6	148	269	<10	446	134	4.38	3.24	2.00	0.16
1-23-80	7.3	13.0	270		1.0	8.8	134	260	<10	436	136	2.33	1.58	1.76	0.03
2-11-80	7.5	13.9	720		0.5		223	359	<10	636	177	7.61	6.05	1.75	0.06
3-12-80	7.9	14.2	275		0.0	14	80	161	95	272	84	0.87	0.44	2.60	0.06
4-16-80	8.6		280		5.0	250	72	124	250	226	62	0.76	0.21	1.24	0.10
5-22-80	7.7	8.3	525		16.5	13	128	224	23	398	107	2.46	1.53	2.33	0.06
6-12-80	7.7	8.6	490		15.5	323	120	228	42	424	101	3.23	2.27	7.01	0.16
7-22-80	7.5	▼4.0	500		23.0	90	111	156	160	368	98	7.21	▼3.74	1.15	
8-27-80	7.7*	6.4	640		23.0	24.0	135	204	32	388	100	3.90	▼2.76	1.23	0.33
9-24-80	7.7	7.8	700		17.0	7.3	138	216	11	472	126	6.32	▼4.91	1.02	0.36

▼ Violation of Ohio Water Quality Standards

● High or Significant Value

* Lab pH

STATION: Black River @ [illegible] Rd

Date	Phosphorus, Total mg/l	Phosphorus, Dissolved mg/l	Chloride mg/l	Flouride, Total mg/l	Cyanide, Total mg/l	Silica SiO_2, Dissolved mg/l	Calcium, Total mg/l	Sodium, Total mg/l	Aluminum, Total ug/l	Arsenic, Total ug/l	Cadmium, Total ug/l	Chromium, Total ug/l	Copper, Total ug/l	Iron, Total ug/l	Lead, Total ug/l
10-22-79			61		0.01	4.73					<5	<30	30	490	<5
11-6-79			98		[redacted]	3.87						60	30		
12-5-79	0.54	0.22	53			8.80					<5	30	<30		
1-23-80	0.51		51		<0.01						<5	<30	<30	900	<5
2-11-80	0.44	0.74	102		<0.01	6.32					<5	<30	<30		
3-12-80	0.26	0.12	28	0.25	<0.01	5.83					<5	30	[redacted]	[redacted]	14
4-16-80	0.350	0.078	16			5.13						<30	<30	<30	
5-22-80	0.390	0.300	43		<0.01	6.61					<5	<30	<30	[redacted]	<5
6-12-80	0.478	0.340	42			8.10					<5		<30		6
7-22-80	1.970	0.880	39			4.76					<100	70	[redacted]	[redacted]	35
8-27-80	0.737	0.593	39			9.40					<5	30	<30		
9-24-80	0.568	0.032	82			7.28					<5	<30	<30	550	8

▼ Violation of Ohio Water Quality Standards

● High or Significant Value

STATION: Black River @ [illegible]

Date	Manganese, Total ug/l	Mercury, Total ug/l	Nickel, Total ug/l	Selenium, Total ug/l	Vanadium, Total ug/l	Zinc, Total ug/l	Total Organic Carbon - mg/l	Dissolved Organic Carbon - mg/l	Phenol ug/l	MBAS mg/l	BOD mg/l	COD mg/l	Fecal Coliform Bacteria - Colonies/100	Fecal Streptococcus Bacteria - colonies/100		
10-22-79		<0.5	100			<30			7			44	14	1300		
11-6-79						110			11			26	[illegible]	13000		
12-5-79						<30	12		.3			18	[illegible]	16,000		
1-23-80		<0.5	<100	<25		<30	14		2			14	[illegible]	20000		
2-11-80						<30	23		4			26	4400	5000		
3-12-80		[illegible]	<100			40	17	11	3			18	[illegible]	25000		
4-16-80						50	23		4			34	[illegible]	10000		
5-22-80		<0.5	100			<30			7			48	100	310		
6-12-80						<30			6			24	540	2800		
7-22-80	190	[illegible]	200			[illegible] 30	32	15	● 10			102	[illegible]	39000		
8-27-80						<30	14	13	7			36	[illegible]	5500		
9-24-80	70	100	100			40	18		6			30	2300	930		

Violation of Ohio Water Quality Standards

● High or Significant Value

STATION: Black River @ 1010 Rd

Date	Phthalic Acid Esters ug/1	Pesticides ug/1	PCB ug/1	Organic Scan	*Aroclor 1016 PCB	*Aroclor 1254 PCB										
10-22-79	<100		<0.05													
11-6-79		0.00	0.00													
12-5-79	<100		*		[illegible]	[illegible]										
1-23-80																
2-11-80	<100		<0.05													
3-12-80	<100		<0.05													
4-16-80	<100															
5-22-80	<100		0.00													
6-12-80	<100		<0.05													
7-22-80	<100		0.00													
8-27-80	<100		0.00													
9-24-80	<100															

◤ Violation of Ohio Water Quality Standards

● High or Significant Value

OHIO EPA WATER QUALITY SUMMARY FOR WATER YEAR 19[illegible]

STATION: BLACK RIVER — FORD RD.

STORET CODE: 501510

USE DESIGNATION: WWH

Date	PH, Field S.U.	Dissolved Oxygen mg/1	Conductivity; Field u mho/cm	Flow, Instantaneous CFS	Water Temperature °C	Turbidity F.T.U.	Alkalinity, Total as CaCO3 - mg/1	Hardness, Total as CaCO3 - mg/1	Suspended Solids mg/1	Dissolved Solids mg/1	Sulfate, SO4 mg/1	Nitrogen TKN mg/1	Nitrogen Ammonia mg/1	Nitrate mg/1	Nitrite mg/1
10-8-80	7.4 LAB	5.7	750	—	14.0	4.4	182	254	<10	568	152	8.18	6.32	0.43	0.12
[illegible]	7.4 LAB	8.5	700	—	9.5		203	288	14	666	179	6.01	11.42	0.39	0.12
12-11-80	—	13.5	360	—	5.0	—	164	220	49	414	120	2.64	1.80	4.23	0.12
1-21-81	7.2 LAB	10.2	850	—	1.5	6.6	200	325	16	862	203	6.62	4.95	1.58	0.0[illegible]
2-19-81	6.8 LAB	14.1	230	—	1.0	395	62	145	473	240	64	3.51	0.45	3.64	0.04
3-18-81	8.0 LAB	12.1	490	—	3.0	5.6	159	244	<10	488	168	3.43	2.91	1.74	0.06
4-22-81	8.1 LAB	10.4	—	—	8.5	20	134	240	27	380	108	2.03	1.04	1.18	0.06
5-13-81	8.1 LAB	9.6	430	—	18.0	28	141	240	47	380	163	1.61	0.56	1.02	0.05
6-30-81	7.8 LAB	6.9		—	23.0	44.5	137	—	50	370	93	4.15	3.19▼	3.86	0.23
7-30-81	7.8	6.3	625	—	19.5	18.5	142	214	23	442	121	3.66	1.96	1.37	0.18
8-31-81	7.6 LAB	-	—	—	23.0	5.4	159	230	<10	500	126	8.74	7.38▼	0.35	0.13
9-11-81	7.7	7.7	—	-	19.0	25.5	115	210	48	382	107	2.56	1.46	1.96	0.1

▼Violation of Ohio Water Quality Standards

●High or Significant Value

STATION: [illegible]

Date	Phosphorus, Total mg/l	Phosphorus, Dissolved mg/l	Chloride mg/l	Flouride, Total mg/l	Cyanide, Total mg/l	Silica SiO_2, Dissolved mg/l	Calcium, Total mg/l	Sodium, Total mg/l	Aluminum, Total ug/l	Arsenic, Total ug/l	Cadmium, Total ug/l	Chromium, Total ug/l	Copper, Total ug/l	Iron, Total ug/l	Lead, Total ug/l
10-8-80	1.61	1.49	100			6.17					<5	<30	<10		
11-19-80	1.36	1.04	117.			5.87	98	41			6	<30	40	● 960	
12-11-80	0.301	0.147				7.2	73	29							
1-21-81	1.02	0.682	223			8.46	106	165			<5	50	30	940	8
2-19-81	0.923	0.143	39			5.25	39	20			<5	<30	40	[redacted]	38
3-2-81	.349	.312	70			5.77					<5	<30	<30		
4-22-81	.343	.197	47			5.91	70	38		<10	<5	<30	<30	[redacted]	<5
5-13-81	.267	.129	35			4.35	62	26			<5	<30	<30	[redacted]	
6-30-81	.466	.344				8.29	62	30			<5	<30	<30		
7-30-81	.730	.566	62			7.08	68	65	600	<10	<5	<30	<30	[redacted]	5
8-31-81	1.23	1.07	92			4.89	67	78			<5	<30	150		
9-11-81	.422	.379	48			9.9			1200	<10	<5	<30	30	[redacted]	11

▼ Violation of Ohio Water Quality Standards

● High or Significant Value

STATION: [illegible]

Date	Manganese, Total ug/l	Mercury, Total ug/l	Nickel, Total ug/l	Selenium, Total ug/l	Vanadium, Total ug/l	Zinc, Total ug/l	Total Organic Carbon - mg/l	Dissolved Organic Carbon - mg/l	Phenol ug/l	MBAS mg/l	BOD mg/l	COD mg/l	Fecal Coliform Bacteria - Colonies/10	Fecal Streptococcus Bacteria - colonies/1
10-8-80		—				80			10 ●			42	500	800
11-19-80		<.5	100			50			17	[illegible]		52	[redacted]	2000
12-11-80						30			14			32	[redacted]	20,000
1-21-81		<.5	100			80	18	10	● 9			32	L.A.	13 000
2-19-81		<.5	100			[redacted]	26	12	● 10			70	[redacted]	55,000
3-12-81						<30			3			16	L.A.	1200
4-29-81		<.5	<100	<100	<80	50			7			22	[redacted]	5600
5-13-81						<30			● 10			26	1600	1800
6-30-81						40	17	14	6			24	[redacted]	—
7-30-81	120	—	100	<5	<200	40	16	11	5	0.15		26	300	200
8-31-81						80			5			38	800	—
9-11-81	110	—	<100	<100	<20	30			5	0.13		110	[redacted]	—

▼ Violation of Ohio Water Quality Standards

● High or Significant Value

STATION: [illegible]

Date	Phthalic Acid Esters ug/l	Pesticides ug/l	PCB ug/l	Organic Scan
10-8-80				
11-19-80	<100		<.5	
12-11-80	<100		<.5	
1-21-81	–		<.5	
2-19-81	<100		<.5	
3-12-81	<100		<.5	
4-22-81	<100		<.5	
5-13-81	<100		<.5	
6-30-81				
7-30-81	<100		<.5	
8-31-81	<100		<.5	

◤ Violation of Ohio Water Quality Standards

● High or Significant Value

SAMPLING SITE: Duck R. Ford Rd STORET CODE:

OHIO EPA WATER QUALITY DATA 1982 W.Y.

Station / Date	Flow/cfs	Water Temp. C°	pH Field S.U.	Dissolved Oxygen mg/1	Conductivity-Field Micromhos	Suspended Solids mg/1	Dissolved Solids mg/1	TKN mg/1	Ammonia Nitrogen mg/1	Nitrite, N mg/1	Nitrate, N mg/1	Total Phosphorus mg/1	Soluble Phosphorus mg/1	BOD, 5 day mg/1	C.O.D. mg/1	T.O.C. mg/1
10/14/81		11.0	7.3	9.3	700	<10	636	8.13	6.10		1.97	1.60	1.44		2.2	12
11/16/81	—	8.5	7.9	8.8	750	<10	574	-	3	-	1.00	1.46	1.30			13
12/8/81	-	3.5	7.74	12.6	[illegible]	16	476	2.5	1.69	0.07	2.99	0.33	0.21	—	32	-
1/6/82		1.0	7.65	14.2	411	154	239	1.95	0.21	0.06	3.03	0.34	0.07		35	
2/17/82		1.0	8.1	14.6	155	107	198	1.90	0.58	0.02	3.78	0.35	0.11		39	-
[illegible]17/82		4.0	7.8	13.2	225	691	293	2.7	0.21	0.06	1.23	0.76	0.18		68	
4-21-82		11.0	8.1	10.6	470	81	434	1.5	0.68	0.10	1.38	0.31	0.15	6.3	27	
5-11-82		16.5	8.1	7.6	750	15	483	4.8	1.9 4.05	—	0.33	0.76	—	13	26	—
6-07-82		17.0	8.0	7.8	660	30	452	2.3	1.33	0.19	2.77	0.55	0.45	-	32	—
8-11-82		20.5	7.5	5.3	750	10	460	4.7	3.71	0.15	0.37	1.29	-	-	43	—
9-14-82		23.0	7.6	3.2	1800	7	664	12.0	2.6 7.65	0.09	0.05	3.55		-	88	-

Violation of State Water Quality Standards
Significantly High Value or Near Violation

SAMPLING SITE: [illegible] STORET CODE:

OHIO EPA WATER QUALITY DATA 1982 WY.

Station / Date	Chloride mg/1	Fluoride mg/1	MBAS mg/1	Fecal Coliform 100 ml	Fecal Strep 100 ml	Fluoride mg/1	Hardness Total $CaCO_3$ mg/1	Copper Total ug/1	Zinc, Total ug/1	Arsenic Total ug/1	Barium Total ug/1	Cadmium Total ug/1	Chromium Total ug/1	Iron Total ug/1	Lead ug/1	Manganese ug/1
10/14/81	115	-		210	160		257	[redacted]	60		-	6	<30		-	
11/16/81	100	-		1000	890		310	70	40		-	<5	<30		<5	-
12/8/81	32	—	—	—			280	15	20			1.4	<30	[redacted]	<5	
1/6/82				[redacted]	27000			15	35	-		2.3	<30		7	
2/17/82				[redacted]	28000		96	[redacted]	30			1.1	<30	[redacted]	8	
3/17/82				[redacted]	44,000		162	30	[redacted]			2.1	<30	[redacted]	20	15
4-21-82				[redacted]	4400		265	25	20			1.4	<30	1120	5	
5-11-82				530	360		—	20	20			1.1	<30	430	2.8	
6-7-82	-	-	—	1900	400	—	257	20	25	-	—	1.0	<30	[redacted]	4	
LAB CLOSED																
8-11-82	-	-	-	390	91	—	161	15	[illegible]			1.1	<10	460	2	
9-14-82	-	-	-	[redacted]	480	-	254	35	80			5.4	<30	450	10	

Violation of State Water Quality Standards
Significantly High Value or Near Violation

SAMPLING SITE: Black R. - Tora Rd STORET CODE: 501510

OHIO EPA WATER QUALITY DATA 1982 WY.

Station / Date	Mercury Total ug/1	Nickel Total ug/1	Oil-Grease mg/1	Cyanide mg/1	Phenols ug/1	Pesticide (15) ug/1	Radiological Beta Total pc/1	Radiological Alpha Total pc/1	Turbidity (FTU)	Alkalinity total $CaCO_3$ mg/l	Sulfate SO_4 mg/l	Silica (Diss, SiO_2) mg/l	Calcium - total	Sodium - total mg/l	Magnesium - Total mg	PCB's	PHTHALIC ACID ESTERS ug/l
10/14/81	-	-	-	-	6		-	-	5.0	176	181	6.2	72	114	-		
11/11/81	-	-	-	-	5			-	4.3	202	156	3.98	94	.1	-	<.5	<100 ug/l
12/8/81	-	<40	-	-	-						-		73,400		23.1	<.5	—
1/6/82	-		-	-	-	-	-	-	-	-			38,600			<.5	—
2/17/82	-	<40	-	-	-	-	-	-	-	-	-		25,400	-	-	<.5	—
3/17/82	-	30	-	-	-	-		-					39,700	-	15.2	<.5	<100
4-21-82		<40											70,000		21.9	—	—
5-11-82	-	-											84,500		25.2	<0.5	<100
6-7-82	-	<40											70,300		14.9	<0.5	<100
LAB CLOSED																	
8-11-82													64,500		17.0	<0.5	
9-14-82		50			19								73,300		17.3	<0.5	<100

Violation of State Water Quality Standards
Significantly High Value or Near Violation

Attachment 2

OHIO EPA FISH INFORMATION SYSTEM
PRINTOUTS FOR THE BLACK RIVER

RIVER 20-001 BLACK RIVER RIVER MILE 4.8 DATES 01-01-82 THRU 12-31-82
SAMPLER TYPE 1 DISTANCE FISHED 1.88 KM

FAM-SPEC CODE	FAMILY NAME	SPECIES NAME	SPC GRP	NO FISH	MEAN NO/KM	% BY NUMBER	MEAN KG/KM	% BY WEIGHT	AVE(GM) WEIGHT	AVE(MM) LENGTH	COND FACTOR
20-003	CLUPEIDAE	GIZZARD SHAD	GS	309	164.36	46.19	0.381	1.07	2.31	61.1	0.74
43-020	CYPRINIDAE	EMERALD SHINER	N	172	91.49	25.71	0.124	0.35	1.36	53.1	0.97
74-001	PERCICHTHYIDAE	WHITE BASS	W	66	35.11	9.87	0.607	1.71	17.31	108.8	1.22
43-002	CYPRINIDAE	GOLDFISH	G	52	27.66	7.77	9.259	26.00	334.76	233.7	2.27
43-001	CYPRINIDAE	COMMON CARP	G	21	11.17	3.14	19.268	54.11	1724.91	480.3	1.34
47-005	ICTALURIDAE	BROWN BULLHEAD	F	10	5.32	1.49	1.378	3.87	259.00	271.4	1.24
74-003	PERCICHTHYIDAE	WHITE PERCH	W	7	3.73	1.05	0.012	0.03	3.14	61.4	1.08
77-013	CENTRARCHIDAE	PUMPKINSEED	S	7	3.72	1.05	0.098	0.27	26.14	104.6	2.21
43-043	CYPRINIDAE	BLUNTNOSE MINNOW	M	6	3.19	0.90	0.003	0.01	1.00	42.2	1.45
40-016	CATOSTOMIDAE	WHITE SUCKER	R	5	2.66	0.75	0.288	0.81	108.20	170.2	1.00
77-006	CENTRARCHIDAE	LARGEMOUTH BASS	B	5	2.66	0.75	0.158	0.44	59.20	141.8	1.22
43-045	CYPRINIDAE	COM. CARP X GOLDFISH	G	4	2.13	0.60	3.497	9.82	1643.75	447.7	1.93
43-028	CYPRINIDAE	SPOTTAIL SHINER	N	2	1.07	0.30	0.002	0.01	2.00	65.5	0.69
40-010	CATOSTOMIDAE	GOLDEN REDHORSE	R	1	0.53	0.15	0.513	1.44	965.00	424.0	1.27
43-003	CYPRINIDAE	GOLDEN SHINER	N	1	0.53	0.15	0.023	0.06	43.00	147.0	1.35
77-009	CENTRARCHIDAE	BLUEGILL	S	1	0.53	0.15	0.001	0.00	2.00	55.0	1.20
		RIVER MILE TOTAL		669	355.86		35.612				
		NUMBER OF SPECIES		16							

RIVER 20-001 BLACK RIVER RIVER MILE 5.8 DATES 01-01-82 THRU 12-31-82
SAMPLER TYPE 1 DISTANCE FISHED 2.00 KM

FAM-SPEC CODE	FAMILY NAME	SPECIES NAME	SPC GRP	NO FISH	MEAN NO/KM	% BY NUMBER	MEAN KG/KM	% BY WEIGHT	AVE(GM) WEIGHT	AVE(MM) LENGTH	COND FACTOR
20-003	CLUPEIDAE	GIZZARD SHAD	GS	164	82.00	78.85	0.187	4.05	2.28	58.2	1.12
43-020	CYPRINIDAE	EMERALD SHINER	N	22	11.00	10.58	0.018	0.39	1.64	61.8	0.67
43-045	CYPRINIDAE	COM. CARP X GOLDFISH	G	5	2.50	2.40	3.488	75.59	1395.00	443.6	1.60
74-001	PERCICHTHYIDAE	WHITE BASS	W	4	2.00	1.92	0.016	0.34	7.75	95.3	0.86
74-003	PERCICHTHYIDAE	WHITE PERCH	W	3	1.50	1.44	0.009	0.20	6.00	75.7	1.09
80-003	PERCIDAE	YELLOW PERCH	V	3	1.50	1.44	0.004	0.09	2.67	67.7	0.74
40-016	CATOSTOMIDAE	WHITE SUCKER	R	2	1.00	0.96	0.144	3.11	143.50	240.5	1.03
47-005	ICTALURIDAE	BROWN BULLHEAD	F	2	1.00	0.96	0.339	7.34	338.50	287.5	1.44
34-001	UMBRIDAE	CENTRAL MUDMINNOW	T	1	0.50	0.48	0.001	0.02	2.00	66.0	0.70
43-001	CYPRINIDAE	COMMON CARP	G	1	0.50	0.48	0.312	6.76	624.00	370.0	1.23
43-002	CYPRINIDAE	GOLDFISH	G	1	0.50	0.48	0.098	2.11	195.00	224.0	1.73
		RIVER MILE TOTAL		208	104.00		4.616				
		NUMBER OF SPECIES		11							

Attachment 3

U.S. STEEL CORPORATION GROUNDWATER
MONITORING PROGRAM PROCEDURES
MANUAL FOR LORAIN WORKS

U.S. STEEL CORPORATION

GROUNDWATER MONITORING PROGRAM

PROCEDURES MANUAL - LORAIN WORKS

This manual is intended for use by the Baker/TSA field sampling team in preparing for and executing the groundwater monitoring program at U.S. Steel Corporation's Lorain Works waste disposal site. The manual addresses the three major phases in the conduct of a field monitoring program: pre-field or office activities, on-site sampling activities and post-sampling activities. Each of these phases is addressed herein by first briefly describing the general tasks that must be considered and then followed by a procedure to be followed in implementing that particular phase.

I. PRE-FIELD OFFICE ACTIVITIES

A. Summary of Tasks to be Performed

Quality control during sampling activities should be the foremost concern in groundwater monitoring activities. The first step toward proper quality control is thorough preparation and pre-planning to minimize scheduling conflicts, uncertainty as to all aspects of the sampling protocol, equipment problems, and time spent during field sampling activities.

Preparation for sampling must involve three elements. First, sampling activities must be closely coordinated (techniques and schedule) with plant and analytical laboratory personnel so that the project activities proceed without uncertainty and delay which can contribute to the loss of sample integrity. Secondly, all necessary equipment and forms must be gathered. Lastly, all sampling personnel should be thoroughly familiar with the operation of all sampling equipment, precautions to avoid sample and bottle contamination, operation of field water quality testing equipment, and record keeping procedures.

The following procedure is to be initiated two (2) weeks prior to the scheduled sampling trip to a USSC facility. It is the responsibility of the appointed Field Team Leader to certify that each task has been completed. To insure that no items have been omitted, a "punch list" of office activities will be used as a basis for directing pre-field activities. It will be up to the Field Team Leader unless otherwise specified to initial each completed task and obtain the Deputy Project Manager's signature on the punch list once all of the tasks have been addressed. Table 1 presents the pre-field punch list to be used by the Field Team Leader in preparing for sampling trips.

B. Procedure

1. The Deputy Project Manager must notify Mike Schack, Lorain Works Environmental Engineer (216/277-2482) at least fourteen (14) days prior to scheduled sampling trip. Provide Mr. Schack with the names of Baker personnel to be involved and the approximate arrival time. Confirm arrangements and request weather and site conditions information two (2) working days prior to arrival. Mr. Russ Stinson, Environmental Engineer, will be the secondary plant contact in the event Mr. Schack is unavailable (Phone 216/277-2482).

2. The Deputy Project Manager must notify Peg Marple at the NUS Laboratory (412/788-1080) about the scheduled sampling trip at least fourteen (14) days before departure. Arrange for the pick-up (or delivery) of the appropriate type and number of sample containers and shipping containers and brief lab personnel on the anticipated date and time that samples will be delivered. A general list of parameters, volume of sample required, container type and holding times is provided as Table A-1 in the Appendix to this manual. The anticipated number of samples and parameters to be measured for each sample and replicate measurements required will be specified to the NUS Laboratory Manager so that the proper number of bottles (with preservatives) and shipping containers are prepared. The facility to be sampled and its location is confidential and is not to be revealed to NUS personnel.

TABLE 1
U.S. STEEL CORPORATION
LORAIN WORKS
PRE-FIELD/OFFICE PUNCH LIST

	Task	Initials	Date
1.	Notify Mike Schack, USSC Plant Env. Engineer (Deputy P.M.)		
	a. Minimum 14 days prior to sampling	________	____
	b. Two working days prior to arrival	________	____
2.	Notify NUS Laboratory (Deputy P.M. or Lab Manager)	________	____
3.	Assemble Sampling Equipment and Completed Equipment Checklist	________	____
4.	Perform Laboratory Calibrations and Check Precision of Field Meters (Lab Manager)	________	____
	a. pH Meter	________	____
	b. Conductivity Meter	________	____
5.	Check Operating Condition and Maintenance Records of Field Equipment	________	____
6.	Assemble Necessary Forms	________	____
	a. Field Log Book	________	____
	b. Field Punch List	________	____
	c. Chain of Custody	________	____
7.	Receive Sample Containers from NUS Laboratory . . .	________	____
8.	Pre-Label Sample Containers	________	____
9.	Review Lorain Works Procedures Manual	________	____
10.	Review Sampling Procedures with Project Team	________	____
11.	Identify and Confirm with the Deputy Project Manager what Samples and Locations are to be used for Quality Assurance	________	____
12.	Make Travel Arrangements		
	a. Motel	________	____
	b. Suburban	________	____
13.	Obtain Punch List Sign-Off by Deputy Project Manager	________	____

____
Deputy Project Manager, Date

3. A checklist to be used in assembling equipment for sampling at Lorain Works which assumes testing for the drinking water parameters (excluding radiological, pesticides, and total coliform bacteria testing), indicator parameters, those parameters indicative of general groundwater quality and naphthalene is included as Table 2. This checklist will vary only slightly, such as when the list of parameters is reduced. This will apply every other sampling period because analysis of the quality parameters are only required annually. Testing for the indicator parameters is required semi-annually. This equipment checklist must be completed and signed by the Field Team Leader.

4. Field meters to be used during sampling, specifically the pH and specific conductance/thermistor meters must be checked against Baker's laboratory meters to insure proper calibration and precision response. This activity is to be performed under the supervision of Baker's Laboratory Manager. In addition, buffer solutions and a standard KCl solution to be used to field calibrate the pH and conductivity meters must be laboratory tested to insure their accuracy. The preparation date of standard solutions must be clearly marked on each of the containers to be taken into the field. A log for each meter must be maintained by Baker's Laboratory Manager which documents problems experienced with the meter, corrective measures taken, battery replacement dates, when used and by whom. Appropriate new batteries must be kept with the meters to facilitate immediate replacement, when necessary in the field.

5. All equipment to be utilized during the field sampling must be examined to certify that it is in operating condition. This includes checking the manufacturer's operating manuals to ensure that all maintenance items are being observed. Field notes from previous sampling trips should be reviewed so that any prior equipment problem notations are not overlooked and

TABLE 2

U.S. STEEL CORPORATION
LORAIN WORKS

SAMPLING EQUIPMENT CHECKLIST

SAMPLING AND TESTING EQUIPMENT

Out	In	
__	__	Water Level Meter with Spare Batteries (1)
__	__	pH Meter with Spare Batteries and Spare Electrode, Buffers (1)
__	__	Conductivity Meter with Spare Batteries (1), Standard Solution
__	__	Field Thermometers (2)
__	__	Six Foot Folding Rule (2)
__	__	Containers (wide mouth) for pH, Specific Conductance (8 Minimum)
__	__	Squeeze Bottles (3)
__	__	Ground Plastic
__	__	Five Gallon Carboy, Full of Distilled, Deionized Water (1)
__	__	Glass 2.6 Liter Bottles, Cleaned with Acid and Distilled Water (12)
__	__	Plastic Gallon Jug (2)
__	__	Filter Apparatus (4), Filters (100), Ring Stand & Clamps, Vacuum Pump
__	__	Glass 2.6 Liter Bottles with 5% Nitric Acid Rinse Water (3)

STATIONERY SUPPLIES

__	__	Clipboard (1), Pencils
__	__	Field Log Book, with Basic Information Included (1)
__	__	Field Punch List (1)
__	__	Chain of Custody Forms (2)
__	__	Filament Tape (2 Rolls)
__	__	Project Site Map (1)

__ __ Carbon Paper

__ __ Plastic Leakproof Bags (2)

MISCELLANEOUS

__ __ Coveralls (2)

__ __ Rubber Gloves (2 Pair)

__ __ Custody Seals (10)

__ __ Permanent Ink Markers (3)

__ __ Calculator

__ __ Rain Gear

__ __ Rubber Boots

__ __ Hard Hats, Steel Toed Shoes, Safety Glasses

__ __ Tools

__ __ Knapsack (1)

__ __ Paper Towels (2 rolls)

__ __ Flashlight (1)

__ __ Watch (1)

__ __ Foot Locker Keys (2)

ITEMS OBTAINED AT PLANT OR LOCALLY

__ __ Ice

__ __ Well Keys

NOTE: Confirm with Lorain Works personnel that the peristaltic pump, calibrated bucket, generator, gas can, extension cord, tubing and connectors are available at the site and are in operating condition.

____
Field Team Leader, Date

also to ensure that all necessary repairs to equipment have been carried out.

6. Assemble all necessary forms including the field log book, field punch list and chain of custody sheets. The field log book is a bound, consecutively paginated notebook with duplicate pages used to record field data measurements and observations. It serves as the permanent record of all events occurring during the sampling trip. Entries into the log book must be made in waterproof ink. Information recorded at each sampling site will vary according to site-specific facilities procedures and conditions, but shall, at a minimum, contain the following details:

   a. Sampling date and time
   b. Sampling location and identification number
   c. Names of field crew present at the site
   d. Brief description of weather conditions
   e. Measured groundwater levels
   f. Well evacuation/pumping details prior to sampling
   g. Field water quality measurements, including
      (i) pH
      (ii) specific conductance
      (iii) water temperature
   h. Sampling remarks/observations
   i. Collection of quality assurance/control samples (split or duplicate samples).

   Upon returning to the office, the carbon copy of the field log entries shall be provided for the project files.

   The Field Activities Punch List forms (Table 3) are to be used to record new developments at the USSC facilities, note observations and sampling problems and serve as an agenda for discussions between the Lorain Works Environmental Engineer and Baker's Field Team Leader. It will be the responsibility of the Field Team Leader to see that three (3) copies of the

TABLE 3
LORAIN WORKS
FIELD ACTIVITIES PUNCH LIST

_____ 1. Pre-Sampling Meeting with Lorain Works Environmental Engineer:

a. Static water level measurements taken by USSC:

DM-1 = ______________
DM-2 = ______________
DM-3 = ______________
DM-4 = ______________

b. USSC remarks concerning well evacuations:

c. Other remarks:

_____ 2. Site weather conditions:

a. Day 1:

b. Day 2:

_____ 3. Changes in operation since last visit:

_____ 4. Site conditions during sampling:

_____ 5. Problems encountered during sampling:

____ 6. Any observations or remarks concerning site visit:

____ 7. Post-sampling meeting with USSC representative:

USSC Representative, Date	Field Team Leader, Date Michael Baker, Jr., Inc.

Field Activities Punch List are provided to USSC's Lorain Environmental Engineer at the time of visit and that the original form is provided to the Deputy Project Manager. The Deputy Project Manager is charged with sending three (3) copies to USSC's Corporate Headquarters. Also, a copy of this completed form is to be retained by the Field Team Leader and the original is to be placed in the project files.

The chain of custody forms document specific details concerning numbers and types of bottles obtained for each sample; sample preservation details; scheduling and personnel involved; and custody details. The records consist of a form, an example of which is shown in Figure 1. The original accompanies the samples from the time sample bottles are prepared at the NUS laboratory through sample collection and analyses. When NUS completes the analyses, this original is to be returned by NUS to the Deputy Project Manager for inclusion into the project files. A carbon copy is retained by the Field Team Leader and is also given to the Deputy Project Manager for the project file after the sampling crew returns to the office.

7. The arrangement of sample container pick-up or delivery with NUS Laboratory shall be made such that sufficient time to correct errors or request additional containers can be made prior to sampling trip departure. Once sample bottles and shipping containers are received by Baker it is the responsibility of the Field Team Leader to check that the proper number and type of equipment has been supplied.

8. To avoid unnecessary delays in the field and serve as a check on the completeness of the sample containers, bottles are to be prelabeled to the extent possible in the office. Sample bottle labelling will be accomplished using pre-printed sticky back labels supplied by NUS. In order to maintain confidentiality, the only information that will be given on the label will be Baker's name and a sample number. The site will be

FIGURE 1

CHAIN OF CUSTODY RECORD	Sampler Name(s):	Sheet of
Project: U.S. Steel Corporation S.O.# 14364		Michael Baker, Jr., Inc. 4301 Dutch Ridge Road Beaver, PA 15009 (412) 495-7711

NUS Sample I.D. No.	Baker Sample I.D. No.	Sampled		Sample Storage and Preservation Details*											
				Cooling		HNO_3		H_2SO_4/ Cooling		Other		Other		Other	
		Date	Time	No. of Containers	Type/Volume Container	No. of Containers	Type/Volume Container	No. of Containers	Type/Volume Container	No. of Containers	Type/Volume Container	No. of Containers	Type/Volume Container	No. of Containers	Type/Volume Container

General Remarks:	*NOTES: Record type of container used with abbreviation P (plastic) or G (glass) Record volume of container in liters
Relinquished By (Sign): Date: Time: Remarks:	Received By (Sign): Date: Time: Remarks:
Relinquished By (Sign): Date: Time: Remarks:	Received By (Sign): Date: Time: Remarks:
Relinquished By (Sign): Date: Time: Remarks:	Received By (Sign): Date: Time: Remarks:
Relinquished By (Sign): Date: Time: Remarks:	Received By (Sign): Date: Time: Remarks:
Relinquished By (Sign): Date: Time: Remarks:	Received By (Sign): Date: Time: Remarks:

Distribution:
Original - Sent with samples to lab (return with lab results to Project Manager for filing)
Copy - Retained by sampling personnel for filing

not be identified. After marking, labels will be taped over with clear tape to prevent the label from peeling off due to contact with water and ice in coolers during sampling. The field log book will contain the cross-reference of sample number versus monitoring well number.

To avoid confusion in the field and possible introduction of contaminants, sample bottles shall contain the appropriate preservative prior to departing. Baker's Laboratory Manager shall arrange this with NUS Laboratory so that the preservatives are identified on the bottles.

9. One day before the scheduled sampling trip, the Field Team Leader and/or Deputy Project Manager shall assemble the field sampling crew and review the manual and sampling procedures to be utilized at the Lorain Works. Prior to this meeting the Deputy Project Manager and Field Team Leader shall review and discuss previous sampling trips to the facility and identify areas of concern or techniques to be utilized at the site.

10. It shall be the responsibility of the Deputy Project Manager to select and maintain records of quality control samples taken during the course of the sampling program. The Deputy Project Manager shall randomly select samples to be collected at a particular facility for duplication or splitting and inform the Field Team Leader as to what sites are to be used for quality control during each sampling trip. It will then be the Field Team Leader's responsibility to see that the proper bottles are assembled and quality control sampling is implemented in the field.

11. The final step in the preparation activities procedure will be for the Deputy Project Manager and Field Team Leader to review the Pre-Field Activities Punch List and for the Deputy Project Manager to sign and date this form. The punch list shall then be placed in the project files.

II. ON-SITE ACTIVITIES

A. Summary of Tasks to be Performed

Three main tasks must be accomplished on-site at the Lorain Works. First a pre-sampling meeting with USSC's plant environmental engineer or designated representative must be conducted to brief the field crew on plant procedures and safety and accident requirements and operations at the facility; review Baker's anticipated schedule of activities on-site; and collect any information relevant to the project. Next the actual sampling of groundwater must be carried out in a manner consistent with previous samplings and under strict quality control procedures as specified in this manual. Finally, the Field Team Leader must meet with USSC's plant environmental engineer to discuss the completed sampling process and provide USSC with three (3) copies of the Field Activities Punch List.

B. Procedure

1. The Lorain Works sampling procedure differs from other sites in that U.S. Steel personnel will measure the static water level and evacuate the wells the day before the Baker/TSA field crew arrives to take the groundwater samples. Mr. Schack or his representative will take water level readings with a weighted line, then purge the wells using a peristaltic pump connected to Tygon tubing that has been installed at each well. Wells DM-2 and DM-3 will be pumped until dry due to their small volume and slow recharge rates. Wells DM-1 and DM-4 will either be pumped dry or until three (3) well volumes are removed, depending on site conditions. The well volumes can be calculated using the following formula:

   $$V = 0.459\ [D-(M-S)]$$

   Where: V = Volume in gallons

   D = Total well depth (feet) below ground

M = Depth (feet) to water below top of steel casing

S = Stickup (feet) of steel casing above ground

2. Immediately upon arrival at the facility to be sampled the Field Team Leader shall meet with the designated Lorain Work's environmental engineer. The meeting agenda shall include the following items:

   a. Review of facility procedures and USSC's chain of command at the site.
   b. Review of proper procedures for on-site safety, accident and personal injury procedural requirements.
   c. Baker's anticipated sampling schedule.
   d. Changes in operation since the last visit.
   e. Exchange of information regarding data collection by USSC that is relevant to the project. This shall include the static water level measurements taken at each of the wells by USSC prior to purging.
   f. Any other topics pertinent to the sampling or other aspects of the monitoring program.
   g. Recent weather conditions.
   h. Obtain visitor passes for expected sampling period duration.

3. The specific sampling procedures are listed below. Note that all field measurements and observations must be entered into the field log book while at the sampling site.

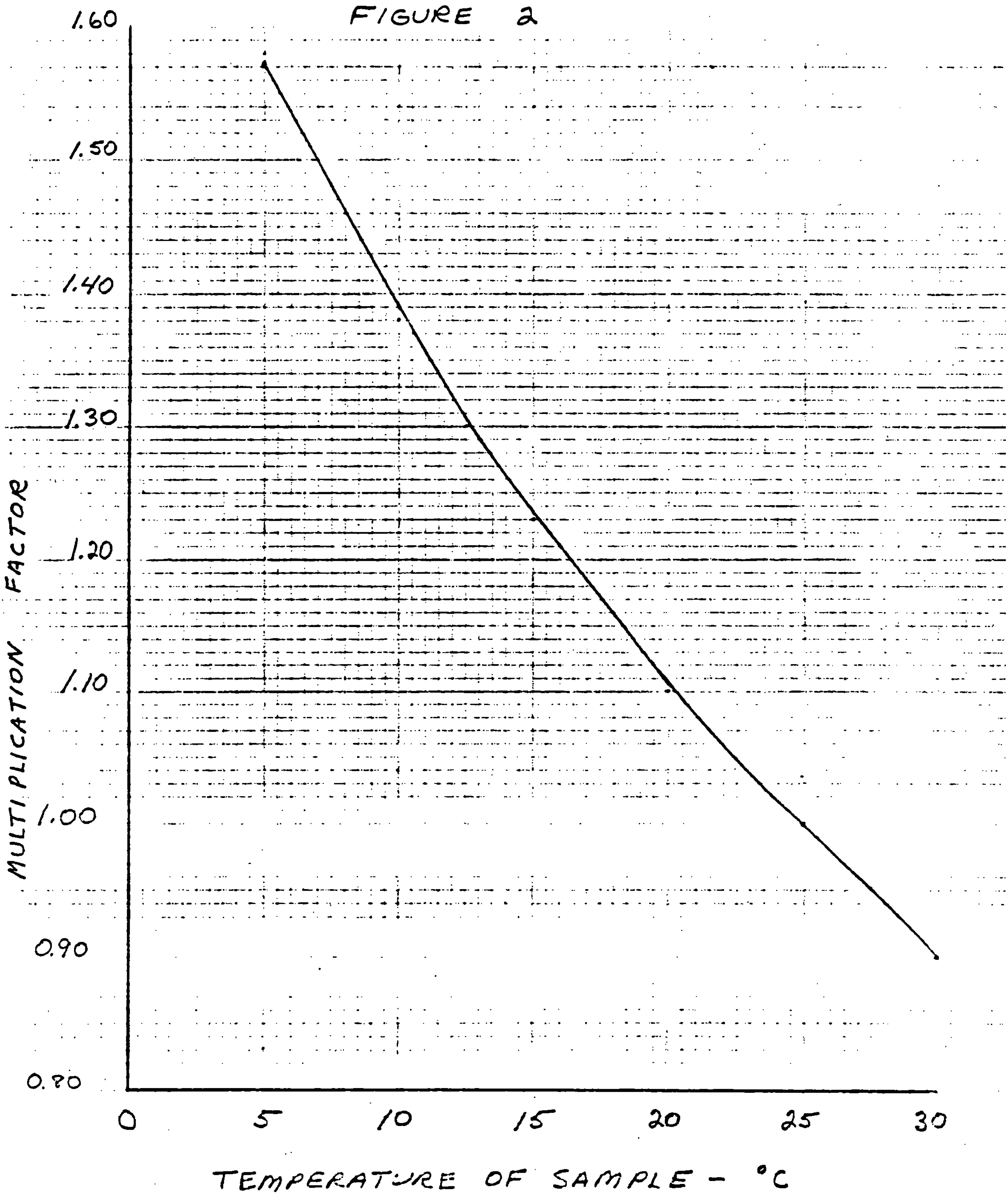
   a. Measure the groundwater level in the monitoring well. This measurement shall be taken using an electric water level meter. The meter probe which contacts the well water surface must be rinsed with distilled water before use. Measurements are to be estimated to the nearest hundredth-of-a-foot using a folding six (6)-foot engineer's rule to measure between the typical five (5)-foot marks on the meter wire. Measurements are taken with respect to the depth below the rim of the steel protective well casing and recorded in the field log book, noting that this measurement is just prior to sampling rather than representing the static water level, since the well was purged the preceding day. All water level measurements should be obtained before proceeding with the sampling activities.

b. Calibrate the field meters. The pH meter must be calibrated twice each day using two different pH buffer solutions. Rinse the probe thoroughly between buffer measurements with distilled/deionized water and again after calibration is completed. Record in the field log book what buffer solutions were used. To check the pH meter standardization, select a third pH buffer solution in the expected pH range of the well water samples and take a measurement. If the reading differs by more than 0.1 pH units, recalibrate the instrument. If unacceptable deviations still occur, consult the operating manual for remedial course of action. At each well, check pH reading by measuring the pH value of a buffer solution in the expected range of the well water. If the reading deviates from the known value by more than 0.1 standard units, recalibrate the instrument as previously described above. The specific conductance/thermistor meter is less likely to exhibit random fluctuations and will only require daily standardization against a known KCl solution. Note that specific conductance is temperature-dependent and therefore the meter readings must be adjusted to reflect the temperature of the standard solution (see Figure 2). Thoroughly rinse the probe with distilled/deionized water after immersing in KCl standard solution. In addition to daily standardization of the conductivity readings, the thermistor readings must also be checked daily. This is accomplished by taking a temperature reading of the KCl standard solution with both the conductivity probe and a mercury thermometer.

THE BAKER ENGINEERS
Box 280
Beaver, Pa. 15009

Subject: TEMPERATURE COMPENSATION CHART
Sheet No. ____ of ____
Drawing No. ____
Computed by AEP Checked by ____ Date ____

FIGURE 2



c. Sampling will be accomplished using the peristaltic pump. Common hosing from the peristaltic pump must be thoroughly flushed with distilled/deionized water before each use to prevent cross-contamination between wells. The well sampling sequence to follow will be DM-3, DM-2, DM-1 and finally, DM-4. The peristaltic pump will be connected to the Tygon tubing previously installed at each of these wells to collect the samples.

d. Due to the minimal amount of water contained in the monitoring wells, sufficient sample volume may not be available by utilizing continuous pumping. Therefore, the sampler may need to implement the following procedure in order to obtain enough sample water to perform the requisite analyses.

(i) Fill four (4) wide-mouth plastic containers for immediate replicate analyses of pH and specific conductance.

(ii) Take an immediate measurement of well water temperature using a field thermometer placed in one of the wide-mouth containers.

(iii) A total of three (3), 2.6 liter glass, acid and distilled/deionized water rinsed bottles also need to be filled. These bottles are used to transport the samples to the filtering station. However, it is likely that the original well volume will be depleted after filling the first or second bottle.

(iv) If insufficient sample is obtained at first, return collected samples to the vehicle and put glass containers on ice.

(v) Take the four (4) replicate field measurements of pH, specific conductance and temperature, following manufacturer's instructions using the sample contained in the wide-mouth plastic containers. Record replicate values in the field log book. Be certain to standardize the pH meter at least twice during each day of sampling. Also, be certain to "red line" the specific conductance meter before taking measurement, double check the range setting on the meter before recording reading and record the temperature of the sample for later adjustment of specific conductance to 25°C. Record pH values to the nearest one-tenth of a standard unit (S.U.), temperature in degrees Celsius (°C) and specific conductance in µmhos/cm.

(vi) Return to the well to pump out enough water to fill the remaining 2.6 liter glass bottles. Be certain that the total combined volume in these temporary transport bottles is sufficient to meet the requirements listed in Table 4.

(vii) If, after taking the replicate pH, specific conductance and temperature readings, the well still does not recharge sufficiently to collect enough sample groundwater, allow the well to recover and proceed to the next site.

(viii) Be certain to return to those wells that did not originally yield enough sample and collect the proper amount. Be certain to thoroughly flush out the common tubing on the peristaltic pump to prevent cross-contamination.

TABLE 4
LORAIN WORKS
SAMPLE CONTAINER REQUIREMENTS

I. SEMI-ANNUAL SAMPLING

BOTTLE TYPE	VOLUME	PRESERVATIVES	PARAMETERS
Tinted Glass	1 Liter	Cool, $Na_2S_2O_3$	TOX
Polyethylene	0.2 Liter	Cool, H_2SO_4	TOC
Polyethylene	0.5 Liter	Cool, H_2SO_4	Nitrates
Polyethylene	1 Liter	HNO_3	Arsenic, Barium, Cadmium, Chromium, Lead Mercury, Selenium, Silver
Polyethylene	0.5 Liter	Cool	Fluoride
Clear Glass	2 Liter	Cool	Naphthalene
Tinted Glass	1 Liter	Cool $CuSO_4/H_3PO_4$	Phenols

TABLE 4 (Cont'd)
LORAIN WORKS
SAMPLE CONTAINER REQUIREMENTS

II. ANNUAL SAMPLING

BOTTLE TYPE	VOLUME	PRESERVATIVES	PARAMETERS
Polyethylene	0.5 Liter	Cool	Chloride, Sulfate, Fluoride
Tinted Glass	1 Liter	Cool, $CuSO_4/H_3PO_4$	Phenols
Tinted Glass	1 Liter	Cool, $Na_2S_2O_3$	TOX
Polyethylene	0.2 Liter	Cool, H_2SO_4	TOC
Polyethylene	0.5 Liter	Cool, H_2SO_4	Nitrates
Polyethylene	1 Liter	HNO_3	Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, Silver, Iron, Manganese, Sodium
Clear Glass	2 Liters	Cool	Naphthalene

e. The samples in the temporary glass containers will be returned as soon as possible to the plant laboratory where they will be filtered using a vacuum pump.

f. At the vacuum filtration station, the sample water shall be filtered through 0.45-micron membrane filters. The parameters for analyses and the respective bottles containing proper preservatives will vary based upon whether the sampling is a semi-annual or annual period. Table 4 lists the bottles required for each sample for each situation.

Prior to filtering a new sample, all filtering apparatus must be acid-rinsed, then thoroughly rinsed with distilled/ deionized water. The glass, temporary sample storage bottles must also be thoroughly rinsed with acid and distilled/deionized water before being returned to the field for reuse.

g. All sample containers except the dissolved metals must be immediately put on ice and kept at approximately $4^{\circ}C$ until analyzed.

4. At wells selected for quality control, samples will either be taken in duplicate (to check sampling precision) or split (to check analytical precision). For sites selected (prior to the sampling trip) for duplicate samples, the normal sampling procedure is followed with the exception that two (2) of each of the sample containers as specified in Table 4 are filled.

Split samples are a check on laboratory precision and as such must receive a sample identification number so that the laboratory is unaware of which sample has been split. Sample identification numbers will be determined prior to the sampling trip. It is imperative that the sample number selected for the split sample be recorded in the field log book since it will be the only record of which sample has been split.

To split the sample, the use of a special apparatus with two outlets is required. The water collected from the well is first placed in this acid and distilled/deionized water rinsed container which automatically splits the sample upon exiting. Samples are drawn from both sides and placed in the proper containers as previously discussed. Be certain to maintain sample integrity by always drawing the original sample from one side of the "sample splitter" and the split sample from the other side. Both samples are then treated in the identical fashion as all other samples collected.

5. Sample custody records must be completed at the time of sampling (see Figure 1). The following chain of custody procedure must be implemented by the Field Team Leader to assure sample integrity.

   a. The samples are under custody of the Field Team Leader if:

      (i) they are in his (or her) possession,
      (ii) they are in view after being in possession,
      (iii) they are locked up or sealed securely to prevent tampering, or
      (iv) they are in a designated secure area.

   b. The original of the sample custody form must accompany the samples at all times after collection. A copy of the sample custody form is kept by the Field Team Leader.

   c. When samples are transferred in possession, the individuals relinquishing and receiving will sign, date and note the time on the form.

6. The final step in the on-site activities will be to meet with the USSC plant environmental engineer (or representative) to discuss the sample collection and review the "punch list" for on-site activities. Upon reviewing the items contained in the punch list, the Field Team Leader and USSC representative must sign and date the form. The Field Team Leader must arrange for obtaining three copies of the punch list by photocopying the original at the USSC facility. The Field Team Leader must retain the original copy so that additional copies of the punch list can be made back at the office (three copies to USSC headquarters, one for the Field Team Leader and one for the Project Files).

III. POST-SAMPLING ACTIVITIES

A. Summary of Post-Sampling Tasks

The post-sampling activities center around returning samples to the NUS Laboratory for analysis and filing the necessary documentation of the sampling trip. In addition, sampling equipment and field meters must be properly stored and any required maintenance and/or repairs performed. Diligent care must be taken during this phase of the sampling program to insure that samples and equipment are properly cared for since fatigue from the sampling trip may cause carelessness.

B. Procedure

1. Once the samples have been collected, it is the responsibility of the Field Team Leader to arrange for delivery of the shipping containers to the NUS Laboratory and insure that the proper chain of custody is documented.

   a. The Field Team Leader or designee must deliver the samples to the NUS Laboratory as soon as possible after returning from Lorain Works. At the transfer of sample custody the shipping containers are to be examined to certify that they have not been disturbed and this observation, along with proper signatures (Baker and NUS personnel), dates and time of custody transfer must be noted on the sample handling form. The form will remain with the samples and be returned by NUS along with the results of the sample analyses for placement in project files.

2. Upon returning to the office the Field Team Leader must:

   a. Provide a copy of the field log pages for the project file. The field log book must be stored in a secure area for safekeeping.

   b. Photocopy the Field Activities Punch List and provide three copies to the Deputy Project Manager, who in turn sends them to USSC Headquarters in Pittsburgh. The original copy must be placed in the project files and a copy retained by the Field Team Leader.

   c. The copy of the custody form must be placed in the project files. When received by Baker from NUS, the original custody form must also be placed in the project files.

   d. The Field Team Leader must prepare a brief memorandum describing the trip and any problems associated with sample collection or equipment, site access, site conditions or pertinent observations. This memo will serve as internal documentation and note areas where revisions or remedial actions are required before the next trip. This memo should be reviewed by the sampling crew for additions or deletions and addressed to the Deputy Project Manager for his review.

3. Sampling gear and any other equipment used must be checked to ascertain its condition after transport from the site. All

necessary repairs and maintenance items as specified by the equipment operating manual must be pursued as soon as possible after return to the office. The Field Team Leader must prepare a list of items necessary to be addressed before the sampling equipment is ready to be taken into the field and the recommended course of action to be followed in preparing the equipment for the next trip. Particular attention must be taken with respect to replenishing expendable supplies and replacing spare parts used during the trip. The Field Team Leader will be responsible for overseeing equipment repair and replacement activities.

APPENDIX

TABLE A-1

USSC GROUND WATER MONITORING PROGRAM
GENERAL PARAMETERS LIST

REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Parameter	Container[1]	Volume Required (ml.)	Preservative[2]	Maximum Holding Time[3]
Temperature	P,G	-	None Required	Analyze Immediately
Bacterial Tests				
Coliform, total	P,G	100	Cool, 4°C 0.008% $Na_2S_2O_3$[6]	6 hours
Inorganic Tests				
Chloride	P,G	50	None Required	28 days
Fluoride	P	300	None Required	28 days
Hydrogen ion (pH)	P,G	-	None Required	Analyze Immediately
Nitrate & Nitrite	P,G	100	Cool, 4°C H_2SO_4 to $pH < 2$	28 days
Specific conductance	P,G	-	Cool, 4°C	28 days
Sulfate	P,G	50	Cool, 4°C	28 days
Turbidity	P,G	100	Cool, 4°C	48 hours
Metals[4]				
Mercury	P,G	100	HNO_3 to $pH < 2$	28 days
Metals, except above	P,G	200	HNO_3 to $pH < 2$	6 months

TABLE A-1 (Continued)

REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Parameter	Container[1]	Volume Required (ml.)	Preservative[2]	Maximum Holding Time[3]
Organic Tests				
Organic carbon	P,G	25	Cool, $4^{o}C$ HCl or H_2SO_4 to pH < 2	28 days
Phenols	G only	500	Cool, $4^{o}C$ H_2SO_4 to pH < 2	28 days
Purgeable halocarbons[5]	G, Teflon-lined septum	-	Cool, $4^{o}C$ 0.008% $Na_2S_2O_3$[6]	14 days
Naphthalene	G	500	Cool, $4^{o}C$	7 days prior to extraction, 30 days for analysis after extraction
Pesticides Tests				
Pesticides	G, Teflon-lined cap	-	Cool, $4^{o}C$ pH 5-9[7]	7 days until extraction, 40 days after extraction
Radiological Tests				
Alpha, beta and radium	P,G	-	HNO_3 to pH < 2	6 months

TABLE A-1
NOTES

1. Polyethylene (P) or Glass (G).

2. Sample preservation should be performed immediately upon sample collection.

3. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still considered valid.

4. Samples should be filtered immediately on-site before adding preservative for dissolved metals.

5. Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.

6. Should only be used in the presence of residual chlorine.

7. The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted with 72 hours of collection. For the analysis of aldrin, add 0.008% $Na_2S_2O_3$.

Sources: U.S. EPA. 1982. Handbook for Sampling and Sample Preservation of Water and Wastewater. EPA-600/4-82-029. 402 p.

U.S. EPA. 1979. Methods for Chemical Analysis of Water and Wastes. EPA-600/4-79-020. 460 p.

TABLE A-2

USSC GROUNDWATER MONITORING PROGRAM
METHODS OF ANALYSIS AND DETECTION LIMITS

Parameter	Method of Analysis	Detection Limit
Group 1: Groundwater Contamination Indicators		
1. pH	glass electrode	± 0.1 pH unit
2. Specific Conductance	conductivity meter	not applicable
3. Total Organic Carbon	combustion-infrared	1 mg/l
4. Total Organic Halogens	microcoulimetric titration	0.01 mg/l
Group 2: Groundwater Quality		
5. Chloride	potentiometric	0.4 mg/l
6. Sulfate	turbidimetric	1 mg/l
7. Iron	AA	0.01 mg/l
8. Manganese	AA	0.01 mg/l
9. Sodium	AA	0.002 mg/l
10. Phenolics	distillation	0.01 mg/l
Group 3: Drinking Water		
11. Arsenic	AA	0.001 mg/l
12. Barium	AA	0.1 mg/l
13. Cadmium	AA	0.005 mg/l
14. Chromium	AA	0.01 mg/l
15. Lead	AA	0.03 mg/l
16. Mercury	AA	0.0002 mg/l
17. Selenium	AA	0.002 mg/l
18. Silver	AA	0.01 mg/l
19. Fluoride	electrode	0.02
20. Nitrate (as N)	colorimetric, brucine	0.1
21. Endrin	GC	0.01 µg/l
22. Lindane	GC	0.005 µg/l
23. Methoxychlor	GC	0.05 µg/l

TABLE A-2

- Continued -

Parameter	Method of Analysis	Detection Limit
Group 3: Drinking Water (Continued)		
24. Toxaphene	GC	0.25 mg/l
25. 2,4-D	GC	0.5 mg/l
26. 2,4,5-TP Silvex	GC	0.05 mg/l
27. Radium (226)	scintillation counter	1.0 pCi/l
28. Gross alpha	proportional counter	5.0 pCi/l
29. Gross beta	proportional counter	5.0 pCi/l
30. Total coliforms	membrane filter	1/100 ml
Group 4: Miscellaneous Additional Monitoring		
31. Alkalinity	titrimetric	1 mg/l
32. Total dissolved solids	glass fiber filtration	1 mg/l
33. Ammonia nitrogen	distillation, electrode	0.1 mg/l
34. Chemical oxygen demand	titrimetric (dichromate digestion)	5 mg/l
35. Nickel	AA	0.03 mg/l
36. Copper	AA	0.01 mg/l
37. Zinc	AA	0.01 mg/l
38. Cyanides	reflux distillation, colorimetric	0.005 mg/l
39. Volatile Organics	GS/MS	not applicable